



BetaPAT *Plus* MI 3304
OmegaPAT *Plus* MI 3305
User Manual

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1 General description

OmegaPATPlus / BetaPATPlus is a portable test instrument intended for testing the electrical safety of portable electrical equipment. The following tests can be performed:

- › earth bond resistance,
- › insulation resistance,
- › substitute leakage current,
- › differential leakage current,
- › touch leakage current,
- › functional test,
- › IEC cord polarity test,
- › portable RCD test
- › flash test (MI 3305 – OmegaPATPlus only),
- › TRMS leakage and load currents with current clamp.

Some instrument's highlights:

- › large graphic LCD display with resolution of 240×128 dots, with back-light,
- › over 6500 memory locations in data flash memory for autotest results,
- › four communication ports (USB and RS232C) for communication with PC, barcode reader or printers,
- › soft touch keyboard with cursor keys,
- › built in real time clock,
- › fully compatible with new METREL PATLink PRO PCSW package,
- › best suited for periodic testing,
- › fast testing with barcode identification systems,
- › test data can be uploaded from PC,
- › comparisons between old and new test results can be performed on site,
- › enables printing of test labels on site.

1.1 Warnings

In order to reach high level of operator safety while carrying out various measurements using OmegaPATPlus / BetaPATPlus instrument, as well as to keep the test equipment undamaged, it is necessary to consider the following general warnings:

- **Read this user manual carefully, otherwise use of the instrument may be dangerous for the operator, for the instrument or for the equipment under test!**
- **If the test equipment is used in manner not specified in this user manual the protection provided by the equipment may be impaired!**
- **Use only correctly earthed mains outlets to supply the instrument!**
- **Do not use the instrument and accessories if any damage is noticed!**
- **In case a fuse has blown follow the instructions in this user manual to replace it!**
- **Instrument servicing and calibration is allowed to be carried out only by a competent authorized person!**
- **Use only standard or optional test accessory supplied by your distributor!**

1.2 Warning markings on connector panel

Refer to chapter **2.1 Front panel**.

1.3 Standards applied

The OmegaPATPlus / BetaPATPlus instrument has been manufactured and tested in accordance with the following standards:

Safety:

- EN 61010-1
- EN 61010-31

Electromagnetic compatibility (emission and immunity):

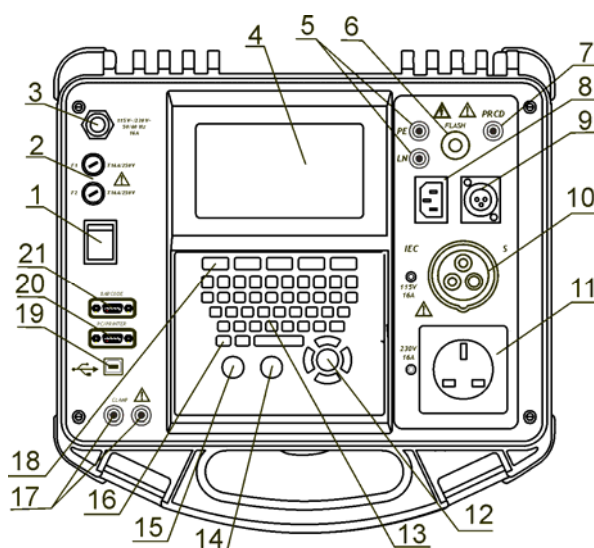
- IEC 61326

Measurements in accordance with:

- British standard BS89
- German standards VDE 0701 and VDE 0702

2 Instrument description

2.1 Front panel



Front panel

Legend:

- 1.....Mains switch with indication lamp.
- 2.....Two T16 A / 250 V fuses for instrument protection.
- 3.....Mains supply cord.
- 4.....240 × 128 dots graphic matrix display with backlight.
- 5.....LN and PE sockets for testing the insulation resistance and substitute leakage current of fixed installed appliances.
Warning! These sockets are intended only for the connection of deenergized appliances.
- 6.....Flash test socket
- 7.....PRCD socket for testing portable residual current devices
Warning! This socket is intended only for connection of portable RCDs.
- 8.....IEC appliance connector for testing supply cords.
Warning! The connector input is only for testing purposes; do not connect it to mains supply!
- 9.....Test probe (earth bond) connector, also used as an input in some class 2 measurements:
insulation resistance, substitute and touch leakage currents (referred to as socket S)
- 10.....Test socket (115 V),
Warning! Dangerous voltage is present on the test socket during the measurement. Maximum output current is 16 A, test only appliances with maximum rated supply current not higher than 16 A!
- 11.....Test socket (230 V).
Warning! Dangerous voltage is present on the test socket during the measurement. Maximum output current is 16 A, test only appliances with maximum rated supply current not higher than 16 A!
- 12.....Cursor keys and ENTER key.

- 13.....Alpha-numeric keyboard.
- 14.....STOP key.
- 15.....START key.
- 16.....ESCAPE key.
- 17.....Current clamp adapter input sockets.
Warning! Do not connect any voltage source on this input. It is intended only for connection of current clamp with current output. Maximum input current is 30 mA!
- 18.....Function keys.
- 19.....USB connector.
- 20.....PC / printer connector.
- 21.....Barcode reader connector.
- 22.....Label printer connector on back side (support for PrintekMobile MtP300 / MtP400 serial printer).

Safety pre-tests

Before performing a measurement, the instrument performs a series of pre-tests to ensure safety and to prevent any damage. These safety pre-tests check for:

- any external voltage against earth on test socket,
- excessively high leakage current,
- excessively high touch leakage current,
- short circuit or too low resistance between L and N on appliance,
- correctly applied mains voltage to the test socket.

If pre-tests fail, an appropriate warning message will be displayed.

The warnings and measures that have to be taken are described in chapter 2.2

Meaning of symbols and messages on the instrument display.

2.2 Meaning of symbols and messages on the instrument display

**Mains voltage is not correct or PE is not connected.
Check mains voltage and PE connection!**

Improper supply voltage warning. Possible causes:

- no earth connection or other wiring problem on supply socket.
- incorrect mains voltage.

Determine and eliminate the problem before proceeding!

L and N are crossed.

Press START key to continue.

The instrument works normally also in the case when L and N are interchanged. Check polarity of line and neutral wires on test socket.

Warning!
Mains voltage is not correct or PE not connected or 110 V centre tapped / IT system.
Press START key to continue if 110 V centre tapped / IT system.

Improper supply voltage warning. Possible causes:

- no earth connection or other wiring problem on supply socket,
- instrument connected to 110 V centre tapped or IT earthing supply system.

Press the START key to continue if instrument is connected to 110 V centre tapped or IT supply system.

Warning!
Instrument is connected to the IT earthing system or PE not connected.
Press START key to continue.

Supply voltage warning. Possible causes:

- no earth connection,
- instrument connected to IT earthing system.

Press the START key to continue if instrument is connected to IT earthing system.

**Resistance L – N too high (>30 kΩ).
Check fuse and switch.
Are you sure to proceed? (Y/N)**

An excessively high resistance was measured in the fuse pre-test. Indication means that appliance has too low consumption or is:

- not connected,
- switched off,
- contains a fuse that has blown.

Select **YES** or **NO** with Y or N key.

**Resistance L – N low.

Are you sure to proceed? (Y/N)**

A low resistance of the appliance' supply input was measured in the pre-test. This means that it is very likely that an excessively high current will flow after applying power to the tested appliance. If the high current is only of short duration (caused by a short inrush current) the test can be performed, otherwise not.

Select **YES** or **NO** with Y or N key.

Resistance L – N too low. Are you sure to proceed? (Y/N)	An extremely low resistance of the appliance' supply input was measured in the pre-test. It is likely that fuses will blow after applying power to the tested appliance. If the too high current is only of short duration (caused by a short inrush current) the test can be performed otherwise it must be stopped. Select YES or NO with Y or N key. It is recommended to additionally check the appliance before proceeding with the test!
Leakage LN-PE high. Are you sure to proceed? (Y/N)	Dangerous leakage current (higher than 3.5 mA) will flow if power would be connected to the tested appliance. Select YES or NO with Y or N key. Proceed with testing only if all safety measures have been taken. It is recommended to perform a thorough earth bond test on the PE of the appliance before proceeding with the test.
Leakage LN-PE too high. Are you sure to proceed? (Y/N)	Dangerous leakage current (higher than 20 mA) will flow if power would be connected to the tested appliance. Select YES or NO with Y or N key. Proceed with testing only if all safety measures have been taken. It is recommended to perform a thorough earth bond test on the PE of the appliance before proceeding with the test.
Leakage LN-PE or EB-PE too high! Are you sure to proceed? (Y/N)	Dangerous leakage current (higher than 20 mA) will flow if power would be connected to the tested appliance. Select YES or NO with Y or N key. Proceed with testing only if all safety measures have been taken. It is recommended to perform a thorough earth bond test on the PE of the appliance before proceeding with the test.
Measurement aborted! Too high leakage current.	An exceptionally high leakage current (higher than about 5 mA) was measured through PE test terminal or PE socket during the pre-test or test.

**Leakage test probe-PE
too high!**

An exceptionally high leakage current (higher than about 5 mA) was measured through S test terminal during the pre-test.

**External voltage on test
socket too high!**

DANGER!

Voltage on test socket or LN/PE terminals is higher than 20 V (AC or DC) approximately!

Disconnect the appliance under test from the instrument immediately and determine why external voltage was detected!

**External voltage on test
probe too high!**

DANGER!

Voltage on test probe (S) is higher than 25 V (AC or DC) approximately!

Disconnect the test probe from the appliance and determine why external voltage was detected!

**Test was skipped for
safety!**

Instrument skipped the required test because of a failed previous test.

**Instrument overheated!

Measurement is
aborted!**

Temperature of internal components of the instrument reached their top limit. Measurement is prohibited until the internal temperature has reduced.

Warning!
More than 80 % of
memory is occupied.
Stored data should be
downloaded to PC.

Instrument memory is almost full. Download stored results to PC.

Warning!
Calibration has been
expired.

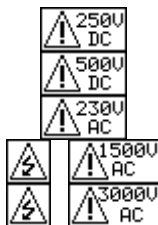
Recalibration of the instrument is required. Contact your dealer.



Connect earth bond test probe in this test.



Remove the earth bond clip, especially if it is connected to any part that will begin to rotate or move when power is applied.



Warning!

A high voltage is / will be present on the instrument output! (Insulation test voltage, flash test voltage (MI 3305 only) or mains voltage).



The appliance under test should be switched on (to ensure that the complete circuit is tested).



Connect the lead to be tested to the IEC plug.



Connect current clamp adapter in this test.

PASS

Test passed.

FAIL

Test failed.

PASS ✱

Some tests in the autotest sequence were skipped, but all performed tests passed.

2.3 Dual voltage operation (UK model only)

The OmegaPATPlus / BetaPATPlus instrument will accept either a 115 V or 230 V, 50 or 60 Hz mains voltage input.

Note:

- The instrument will conduct a load and leakage current tests at the power up mains voltage. Therefore, to perform a differential leakage test and touch leakage test on 115 V appliance, the instrument must be powered up from 115 V mains supply. When instrument is powered up from 230 V, only the 230 V test socket is energized at 230 V during the differential leakage and touch leakage measurements.

3 Technical specifications

3.1 Earth bond resistance

Earth bond resistance readout (10 A and 25 A)

Range	Resolution	Accuracy
0.00 Ω ÷ 1.99 Ω	0.01 Ω	$\pm(5\%$ of reading + 3 digits)
2.00 Ω ÷ 19.99 Ω	0.01 Ω	$\pm 10\%$

Earth bond resistance readout (200 mA)

Range	Resolution	Accuracy
0.00 Ω ÷ 1.99 Ω	0.01 Ω	$\pm(5\%$ of reading + 3 digits)
2.00 Ω ÷ 9.99 Ω	0.01 Ω	$\pm 10\%$
10.0 Ω ÷ 19.9 Ω	0.1 Ω	$\pm 10\%$

Test currents..... 25 A, 10 A ($\pm 5\%$) into 100 m Ω at mains voltage of 230 V AC

200 mA into 2 Ω at mains voltage of 230 V AC

Open circuit voltage .. < 6 V AC at mains voltage of 230 V AC

Pass levels 0.01 Ω ÷ 0.09 Ω , 0.10 Ω ÷ 0.90 Ω , 1.00 Ω ÷ 9.00 Ω

Test duration..... 2 s, 3 s, 5 s, 10 s, 30 s

Output..... Class 1: S test probe connector – test socket (PE)

Test method..... 4-wire measurement, floating to earth

3.2 Insulation resistance

Insulation resistance readout

Range	Resolution	Accuracy
0.000 M Ω ÷ 0.500 M Ω	0.001 M Ω	$\pm(10\%$ of reading + 5 digits)
0.501 M Ω ÷ 1.999 M Ω	0.001 M Ω	$\pm(5\%$ of reading + 3 digits)
2.00 M Ω ÷ 19.99 M Ω	0.01 M Ω	
20.0 M Ω ÷ 199.9 M Ω	0.1 M Ω	

Nominal voltages 250 V DC, 500 V DC (- 0 %, + 10 %)

Measuring current..... min. 1 mA at 250 k Ω (250 V), 500 k Ω (500 V)

Short circuit current... max. 2.0 mA

Pass levels 0.01 M Ω , 0.10 M Ω , 0.50 M Ω , 1.00 M Ω , 2.00 M Ω , 4.00 M Ω , 7.00 M Ω , 10.0 M Ω

Test duration..... 2 s, 3 s, 5 s, 10 s, 30 s

Output..... Class 1: test socket

Class 2: test socket (L+N) – S test probe connector

Test method..... floating to earth

Auto discharge after test.

3.3 Substitute leakage current

Substitute leakage current readout

Range	Resolution	Accuracy
0.00 mA ÷ 19.99 mA	0.01 mA	±(5 % of reading + 5 digits)

Open circuit voltage .. < 50 V AC at mains voltage of 230 V AC

Short circuit current... < 40 mA

Pass levels 0.25 mA, 0.50 mA, 0.75 mA, 1.00 mA, 1.50 mA, 2.25 mA, 3.50 mA, 7.00 mA, 9.90 mA, 15.00 mA

Test duration..... 2 s, 3 s, 5 s, 10 s, 30 s

Output..... Class 1: test socket

Class 2: test socket (L+N) – S test probe connector

Test method..... floating to earth

Displayed current is calculated to appliance mains supply voltage.

3.4 Leakage current and apparent power

Differential leakage current readout

Range	Resolution	Accuracy
0.00 mA ÷ 9.99 mA	0.01 mA	±(5 % of reading + 5 digits)

Pass levels 0.25 mA, 0.50 mA, 0.75 mA, 1.00 mA, 1.50 mA, 2.25 mA, 2.50 mA, 3.00 mA, 3.50 mA, 5.00 mA, 9.90 mA

Test duration..... 2 s, 3 s, 5 s, 10 s, 30 s, 60 s, 120 s, 180 s, none

Output..... Class 1: test socket

Test method..... Current measurement circuit according to VDE 0404-3, Appendix A, Figure A1, IEC 60990 Figure F2

Apparent power readout

Range	Resolution	Accuracy
0.00 kVA ÷ 4.00 kVA	0.01 kVA	±(5 % of reading + 3 digits)

Output..... test socket

3.5 Touch leakage current

Touch leakage current readout

Range	Resolution	Accuracy
0.00 mA ÷ 3.99 mA	0.01 mA	±(10 % of reading + 5 digits)

Pass levels 0.25 mA, 0.50 mA, 1.00 mA, 3.50 mA

Test duration..... 2 s, 3 s, 5 s, 10 s, 30 s, 60 s, 120 s, 180 s, none

Output..... Class 1, Class 2: test socket – S test probe connector

Test method..... Current measurement circuit according to VDE 0404-3, Appendix A, Figure A1, IEC 60990 Figure F2

3.6 Polarity test

Test voltage < 50 V AC

Detects Pass, L-open, N-open, PE-open, L-N crossed, L-PE crossed, N-PE crossed, L-N shorted, L-PE shorted, N-PE shorted, multiple faults

Output..... test socket – IEC socket

3.7 Clamp current

True RMS current readout using 1000:1 current clamp

Range	Resolution	Accuracy ^{*)}
0.00 mA ÷ 9.99 mA	0.01 mA	±(5 % of reading + 10 digits)
10.0 mA ÷ 99.9 mA	0.1 mA	±(5 % of reading + 5 digits)
100 mA ÷ 999 mA	1 mA	±(5 % of reading + 5 digits)
1.00 A ÷ 9.99 A	0.01 A	±(5 % of reading + 5 digits)
10.0 A ÷ 24.9 A	0.1 A	±(5 % of reading + 5 digits)

^{*)} Consider accuracy of current transformer.

Pass levels 0.25 mA, 0.50 mA, 0.75 mA, 1.00 mA, 1.50 mA, 2.25 mA, 2.50 mA, 3.00 mA, 3.50 mA, 5.00 mA, 9.90 mA, none

Test duration..... 2 s, 3 s, 5 s, 10 s, 30 s, 60 s, 120 s, 180 s

Input..... current clamp terminals

3.8 Trip-out time of portable RCD

Portable RCD trip-out time readout

Range	Resolution	Accuracy
0 ms ÷ 1999 ms ($\frac{1}{2} \times I_{\Delta N}$)	1 ms	±3 ms
0 ms ÷ 300 ms ($I_{\Delta N}$)	1 ms	
0 ms ÷ 40 ms ($5 \times I_{\Delta N}$)	1 ms	

Test currents ($I_{\Delta N}$) 10 mA, 15 mA, 30 mA

Test current multipliers $\frac{1}{2} \times I_{\Delta N}$, $1 \times I_{\Delta N}$, $5 \times I_{\Delta N}$

Test modes single, autotest

Output PRCD probe connector – test socket

Trip out times according to EN 61008 / EN 61009 (Aus/NZ models)

$\frac{1}{2} \times I_{\Delta N}^*)$	$I_{\Delta N}$	$5 \times I_{\Delta N}$
$t_{\Delta} > 300$ ms	$t_{\Delta} < 200$ ms	$t_{\Delta} < 40$ ms

Trip out times according BS 7671 (UK models)

$\frac{1}{2} \times I_{\Delta N}^*)$	$I_{\Delta N}$	$5 \times I_{\Delta N}$
$t_{\Delta} > 1999$ ms	$t_{\Delta} < 200$ ms	$t_{\Delta} < 40$ ms

^{*)} The $\frac{1}{2} \times I_{\Delta N}$ current does not trip out the RCD.

3.9 Flash test (MI 3305 – OmegaPATPlus only)

Flash current readout

Range	Resolution	Accuracy
0.00 - 2.50 mA	0.01 mA	±(5 % of reading + 5 digit)

Test voltage 1500 V AC, 3000 V AC

Output resistance 480 kΩ@1500 V, 960 kΩ@3000 V

Limits 1.00 mA, 1.50 mA, 2.00 mA, 2.25 mA

Timer 2 s, 3 s, 5 s, 10 s, 30 s

Output Class 1: test socket

Class 2: test socket (L+N) – flash probe connector

3.10 General data

Rated supply voltage 230 V_{AC} / 115 V_{AC} (±10 %, 50 or 60 Hz)

Max. power consumption 150 VA (earth bond 25 A short-circuit, without tested appliance)

Maximum appliance current 16 A

Overvoltage category Cat II / 300 V

Protection classification I

Pollution degree 2

Degree of protection	IP 50 (closed and locked cover)
Case	shock proof plastic / portable
Display	240*128 dots graphic matrix display with backlight
Dimensions (w×h×d).....	33.5 cm × 16.0 cm × 33.5 cm
Weight (with standard accessories)...	MI 3305 OmegaPAT Plus: 8.95 kg MI 3304 BetaPAT Plus: 7.85 kg
Memory.....	6500 memory locations
RS232 interfaces	1200 bps ÷ 115200 bps, 1 start bit, 8 data bits, 1 stop bit
RS232 connectors	9-pin subminiature type D, female
Label printer connector.....	6-pin DIN connector, female
USB interface	1200 bps ÷ 115200 bps
USB connector.....	type B

Reference conditions

Reference temperature range.....5 °C ÷ 35 °C

Reference humidity range.....35 % ÷ 65 % RH

Operation conditions

Working temperature range -10 °C ÷ +50 °C |Maximum relative humidity 85 % RH (0 °C ÷ 40 °C), non-condensing |

Storage conditions

Temperature range -10 °C ÷ +60 °C |Maximum relative humidity 90 % RH (-10 °C ÷ +40 °C) 80 % RH (40 °C ÷ 60 °C) |

Accuracies apply for 1 year in reference conditions. Temperature coefficient outside these limits is 0.2 % of measured value per °C, and 1 digit.

Fuses

Instrument protection 2 x T16 A / 250 V, 6.3 × 32 mm |

Protection pre-tests

- External voltage between L and PE, N and PE or L and N (DC and AC)
- Excessive leakage between L and PE or N and PE
- Short circuit or very low resistance between L and N

Connectivity (fuse) pre-test

- Appliance not switched on or too high resistance between L and N

Maximum resistance for connectivity pre-test..... 30 kΩ

4 Main menu and test modes

The OmegaPATPlus / BetaPATPlus instrument has a user-friendly manipulation. By pressing only a few keys most of the actions can be done. The menu tree of the instrument has been designed to be simple to understand and easy to operate. The instrument can test appliances in four different modes:

- single test mode,
- three autotest modes.

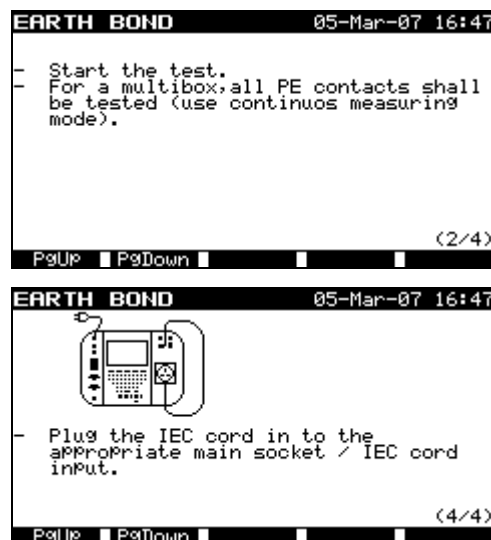
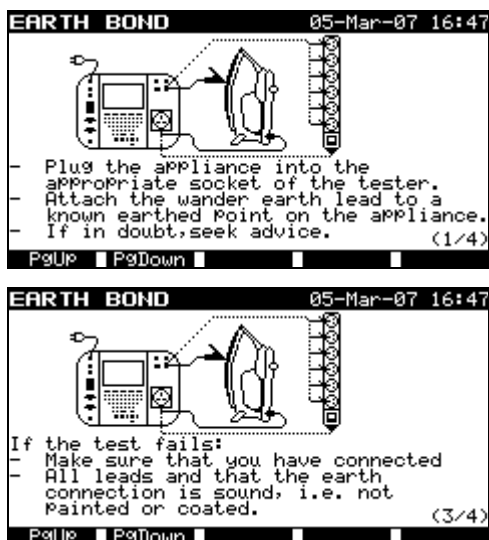
After the instrument is switched on, the last menu used will be displayed.

4.1 Help menus

The measurement help menus are available in single and autotest modes. Help menu contain schematic diagrams for illustration of proper connection of appliance under test to the PAT testing instrument.

4.1.1 How to enter help menu

After entering the selected measurement and before pressing START, press the F2 function key in order to view help menu.

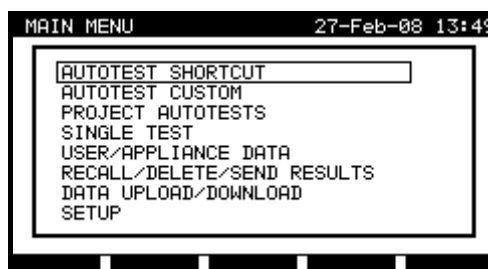


Example of help menus

Use F1 and F2 function keys to see the next / previous page (if available).
Press ESC key to return to the last test / measurement menu.

4.2 Main menu

From the **Main menu** all the instrument functions can be selected.



Main menu

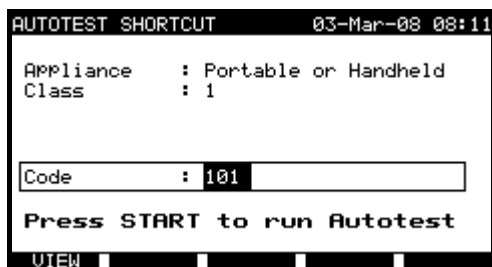
Select the function you want to perform by using $\uparrow$ and $\downarrow$ cursor keys and press ENTER key to confirm. To return to the **Main menu** press the ESC key.

Note:

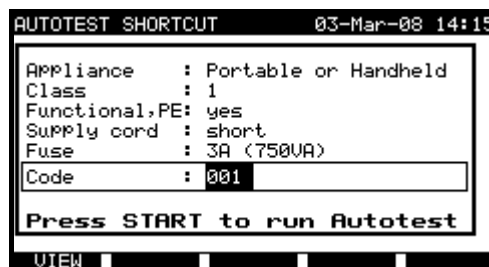
- The ESC key has need to be pressed more than once to return to **Main menu** from any submenu or selected function.

4.3 Autotest shortcut menu

In this menu there are all the most popular pre-defined autotest sequences that can be selected and performed (shown in appendix B and C of this manual). When an autotest sequence has been completed, the measurement results can be stored into instrument flash memory or sent to the printer or PC for further processing.



Aus/NZ model



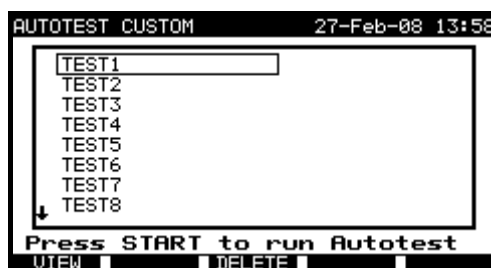
UK model

Autotest shortcut menu examples

See chapter 7 **Autotest sequences** for detailed description of this test mode.

4.4 Autotest custom menu

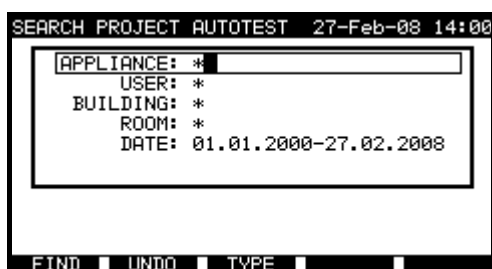
It might happen that none of the preset autotest shortcut sequences corresponds with a particular appliance' test requirements. For this reason, an autotest procedure can be created in the autotest custom menu. In this menu the autotest results can be stored into the instrument flash memory or sent to the PC for further purposes (as well test reports can be printed out, etc.).

*Autotest custom menu*

See chapter 7 **Autotest sequences** for detailed description about this test mode.

4.5 Project autotests menu

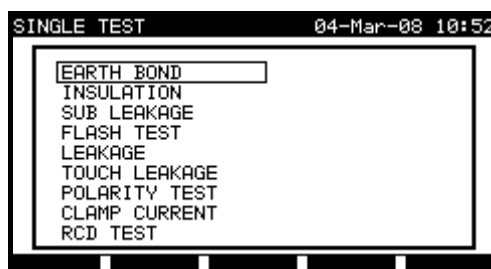
The Project autotest is a tool that simplifies and speeds up repeated (periodic) testing of appliances. The main idea is to re-use known and stored data about the appliance under test.

*Aus/NZ model**UK model**Project autotest menu examples*

See chapter 7.3 **Project autotests** for detailed description about this autotest mode.

4.6 Single test menu

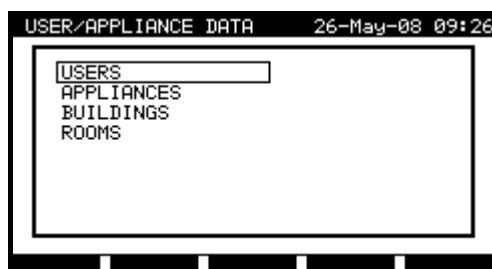
In single test menu individual tests can be performed. Note: that measurement results performed in this mode cannot be stored.

*Single test menu*

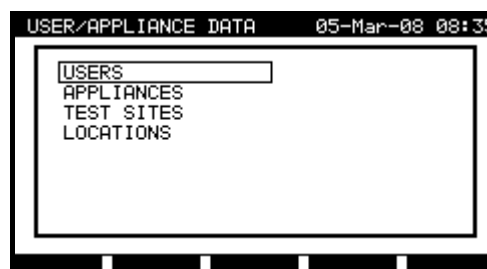
See chapter 5 **Single test mode** for detailed description about the single test mode.

4.7 User / appliance data menu

In this menu lists of user and appliance data default names can be edited. An alternative is to upload the lists from PC.



Aus/ NZ model



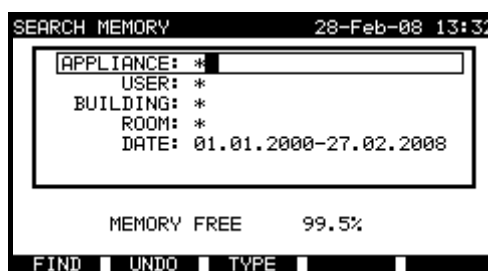
UK model

Users / appliance data main menu

See chapter **9.1 User / appliance data menu** for detailed description about this functionality.

4.8 Recall / delete / send results menu

Manipulation with stored data is allowed in this menu. Stored results can be recalled according to appliance name and date, deleted or send to PC or printers.



Recall results menu

See chapters **8.2 Recalling results**, **8.3 Deleting results** and **8.4 Downloading and printing results** for more information.

4.9 Data upload / download menu

In this menu it is possible to upload different data from PC to the instrument:

- stored test results and data (results, parameters, notes)
- list of default appliance and test site names.

The data to be uploaded are selected in the PCSW package.

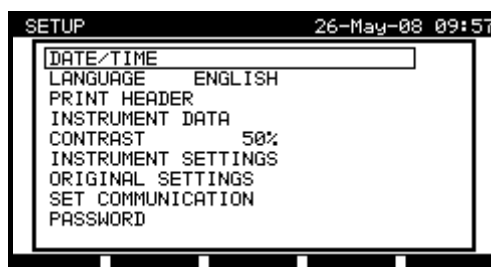


Upload of test data menu

See chapter **9.2 Data upload / download** for detailed description about uploading/downloading data from PC.

4.10 Setup menu

In this menu general instrument parameters can be set.



Setup menu

See chapter **9.3 Setup menu** for detailed description.

5 Single test mode

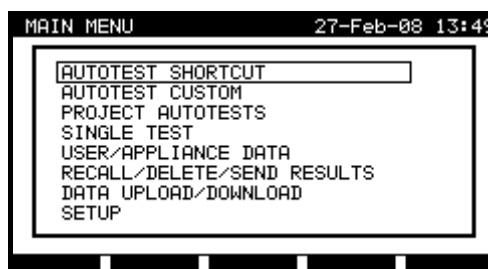
In single test mode, individual tests can be performed. This is especially helpful when the test engineer suspects that one or more faults are present in the appliance under test.

Note:

- Test results cannot be saved in this mode!

5.1 How to perform measurements in single test mode

Select **Single test** in **Main menu** by using ▲ and ▼ cursor keys and press ENTER key to confirm the selection. The **Single test menu** is displayed.



Single test menu

By using ▲ and ▼ cursor keys select the measurement you want to perform and press ENTER key to confirm the selection. To return to the **Single test menu** press ESC key.

Selected test measurement parameters are detailed in the top right corner of the display. These parameters can be edited by pressing the F1 button. In general the following parameters can be set:

- output test voltage/current,
- pass level,
- measurement duration.

Once the test parameters have been set, the settings are saved until new changes are made or the instrument is reset to the default configuration.

Note:

- To keep new settings in the case of a power failure, return to main menu or press SAVE before turning the power off.

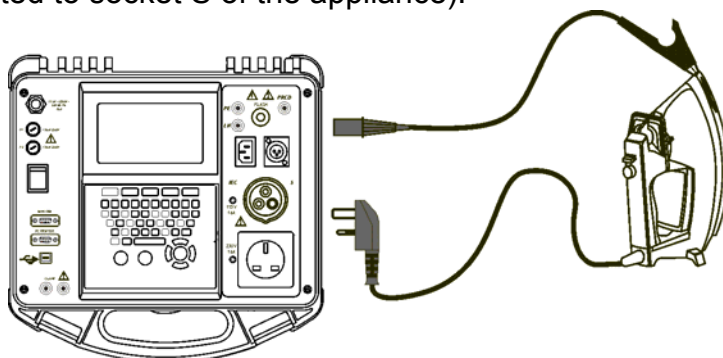
6 Measurements

6.1 Earth bond resistance

This test ensures that the connections between the protective conductor terminal in the mains plug of the appliance and any accessible conductive parts of the appliance (metal housing) are satisfactory and of sufficiently low resistance. This test has to be performed on Class 1 (earthed) appliances.

A high current is normally used to check that the connections will operate correctly under fault conditions. In some sensitive electronic equipment such as computers and other information technology equipment that contain a functional earthing arrangement, a high current test can damage the equipment. In this situation, a 200 mA test current is used to prevent damage to the internal components of the appliance.

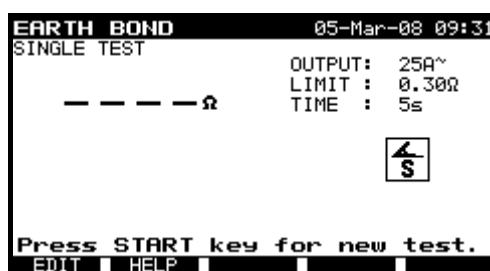
The instrument measures the resistance between test socket's PE terminal and earth bond clip (connected to socket S of the appliance).



Measurement of earth bond resistance of class I appliance

6.1.1 How to perform earth bond resistance measurement

From the **Main menu**, select **Single test** and then select **Earth bond** by using $\blacktriangle$ and $\blacktriangledown$ cursor keys and press ENTER key to confirm. **Earth bond menu** is displayed.



Earth bond menu

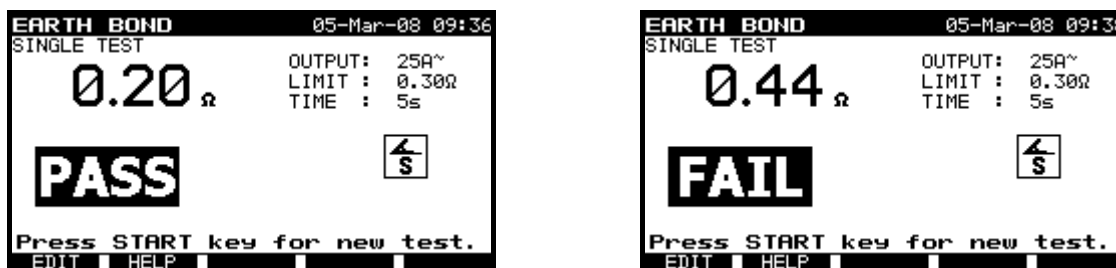
Measurement parameters are detailed in the top right corner of the display. The following parameters can be adjusted:

- nominal test current,
- high limit resistance value,
- measurement duration.

To edit parameters, press the F1 function key first. Use ▲ and ▼ cursor keys to select the parameter you want to edit. By using ◀ and ▶ cursor keys adjust the selected parameter. Press F1 function key again to confirm settings.

Once the settings have been set, press the START key to perform measurement.

The measurement can be aborted by pressing STOP key at any time. The actual result is shown on the display during measurement. After the measurement time period has elapsed the last measured value is displayed, and PASS or FAIL indication appears on the display (based on the high resistance limit defined in the settings).



Examples of earth bond resistance measurement results

Press the START key to repeat the test or press ESC key to return to the **Single test menu**.

Note:

- Consider any displayed warning before starting measurement!

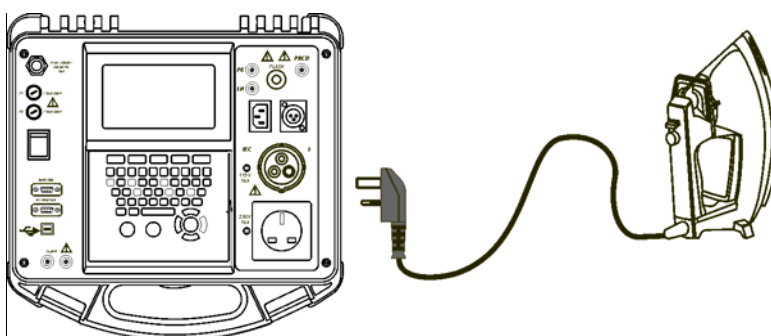
6.2 Insulation resistance

The insulation resistance test checks the resistance between live conductors and earthed (or isolated) accessible metal parts of an appliance. This test can disclose faults caused by pollution, moisture, deterioration of insulation metal etc. The capacitive part of leakage currents is not measured because of the DC test voltage.

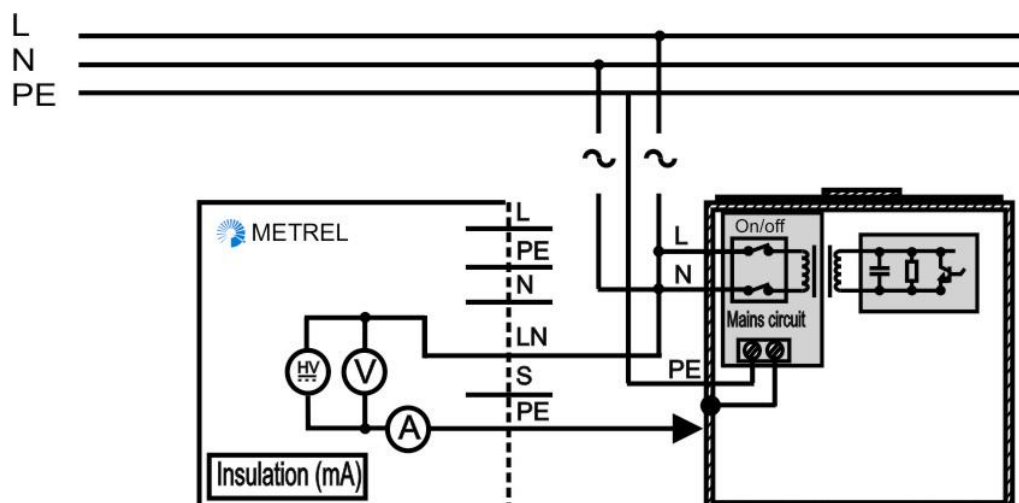
6.2.1 Insulation resistance on class I appliances

The instrument measures the insulation resistance between:

- (L+N) and PE of the relevant test socket,
- LN and PE test sockets.



Measurement of insulation resistance of class I appliance

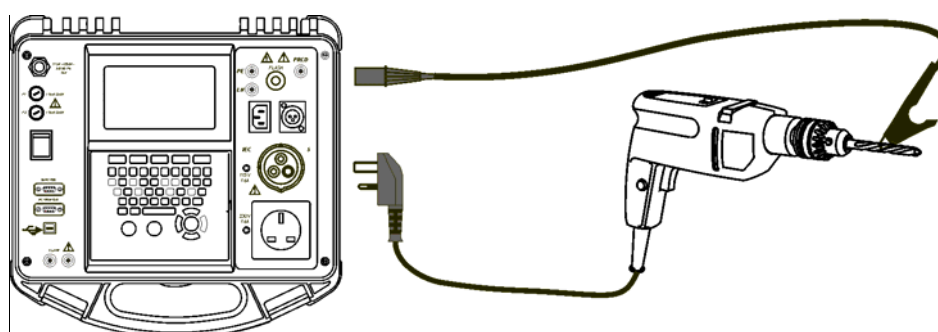


Measurement of insulation resistance of fixed installed appliances of Class I

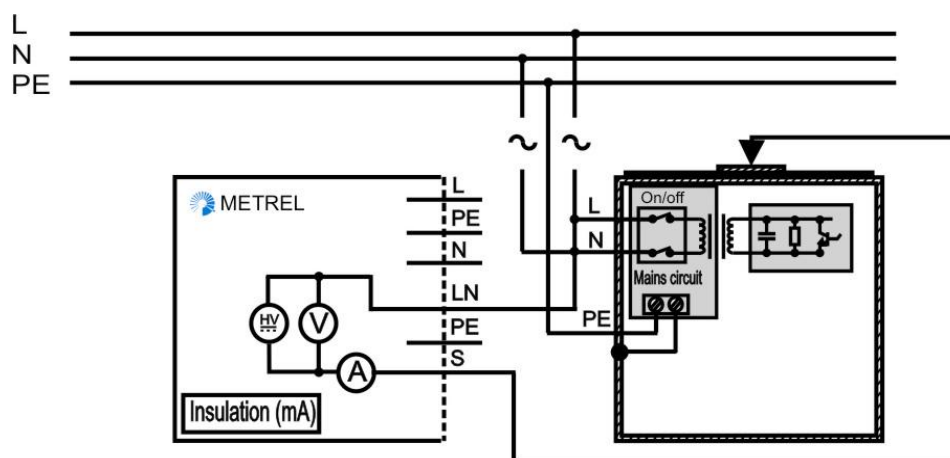
6.2.2 Insulation resistance on class II appliances

The instrument measures the insulation resistance between:

- (L+N) of the relevant test socket and S test terminals,
- LN and S test sockets.



Measurement of insulation resistance of class II appliance



Measurement of insulation resistance of accessible isolated conductive parts of fixed installed appliances

6.2.3 How to perform single insulation resistance measurement

From the **Main menu**, select **Single test** and then select **Insulation** by using $\blacktriangle$ and $\blacktriangledown$ cursor keys and press ENTER key to confirm. **Insulation menu** is displayed.



Insulation menu

Measurement parameters are detailed in the top right corner of the display. The following parameters can be adjusted in this measurement:

- › nominal test voltage,
- › low limit resistance value,
- › measurement duration.

To edit parameters, press the F1 function key first. Use $\blacktriangle$ and $\blacktriangledown$ cursor keys to select the parameter you want to edit. By using $\blacktriangleleft$ and $\blacktriangleright$ cursor keys adjust the selected parameter. Press F1 function key again to confirm the selected settings.

Press the START key to perform a measurement.

The measurement can be aborted by pressing STOP key at any time. The actual result is shown on the display during the measurement. After the measurement time has elapsed the last measured value is displayed, and PASS or FAIL indication appears on the display (based on the low limit resistance value).



Examples of insulation resistance measurement results

Press START key to repeat the test or press ESC key to return to the **Single test menu**.

Notes:

- › The appliance under test should be de-energized before the measurement!
- › Consider any warning on the display before starting the measurement!
- › Do not touch the appliance under test during the measurement or before it is fully discharged! The message »Discharging...« will be displayed while the voltage on the appliance under test is higher than 20 V!

- Do not disconnect the appliance under test from the instrument during the measurement or before it is automatically discharged!

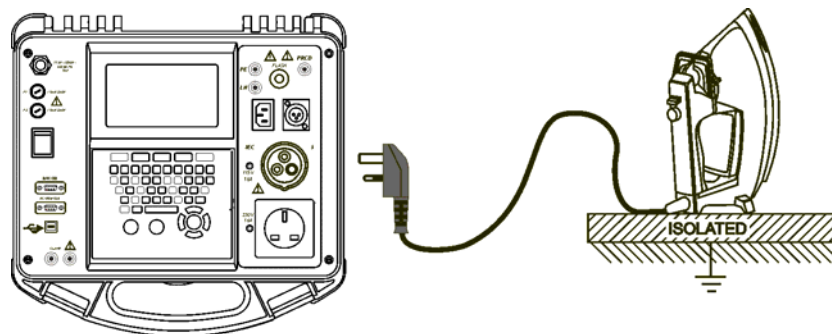
6.3 Substitute leakage current

Leakage currents between live conductors and isolated accessible metal parts (housing, screws, handles etc.) are checked with this test. Capacitive leakage paths are included in the result too. The test measures the current flowing at a test voltage of 40 VAC and the result is scaled to the value of a nominal mains supply voltage of 230 VAC.

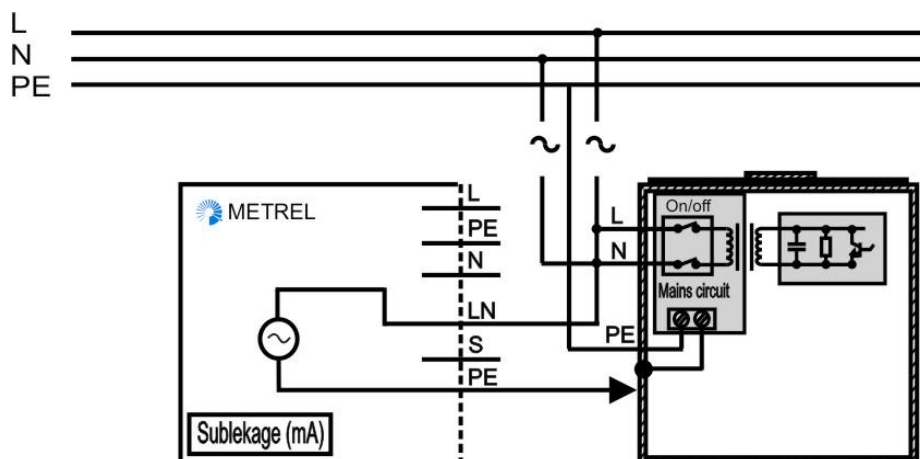
6.3.1 Substitute leakage current on class I appliances

The instrument measures the substitute leakage current between:

- main test socket (L+N) and PE test terminals,
- LN and PE test sockets.



Measurement of substitute leakage current of class I appliance

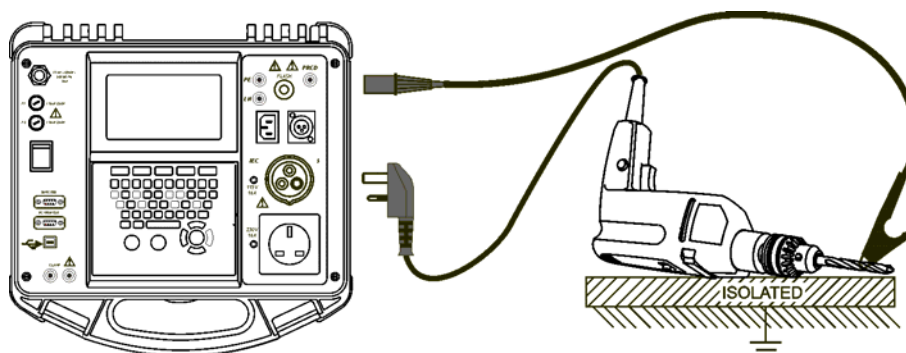


Measurement of substitute leakage current of fixed installed appliances of class I

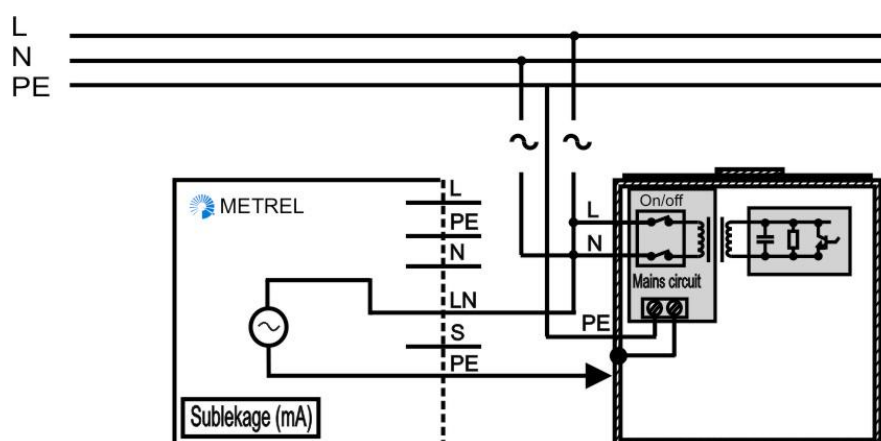
6.3.2 Substitute leakage current on class II appliances

The instrument measures leakage current between:

- main test socket (L+N) and S test terminals,
- LN and S test sockets.



Measurement of substitute leakage current of class II appliance



Measurement of substitute leakage of accessible isolated conductive parts of fixed installed appliances

6.3.3 How to perform single substitute leakage current measurement

From the **Main menu**, select **Single test** and then select **Sub leakage** by using $\blacktriangle$ and $\blacktriangledown$ cursor keys and press ENTER key to confirm. **Sub leakage menu** is displayed.



Sub leakage menu

Measurement parameters are detailed in the top right corner of the display. The following parameters can be adjusted in this measurement:

- high limit leakage value,
- measurement duration.

To edit parameters, press the F1 function key first. Use ▲ and ▼ cursor keys to select the parameter you want to edit. By using ◀ and ▶ cursor keys adjust the selected parameter. Press F1 function key again to confirm the selected settings.

Press the START key to perform measurement.

The measurement can be aborted by pressing STOP key at any time. The actual result is shown on the display during the measurement. After measurement time has elapsed the last measured value is displayed, and PASS or FAIL indication appears on the display (based on the high limit leakage value).



Examples of substitute leakage current measurement results

Press START key to repeat the test or press ESC key to return to the **Single test menu**.

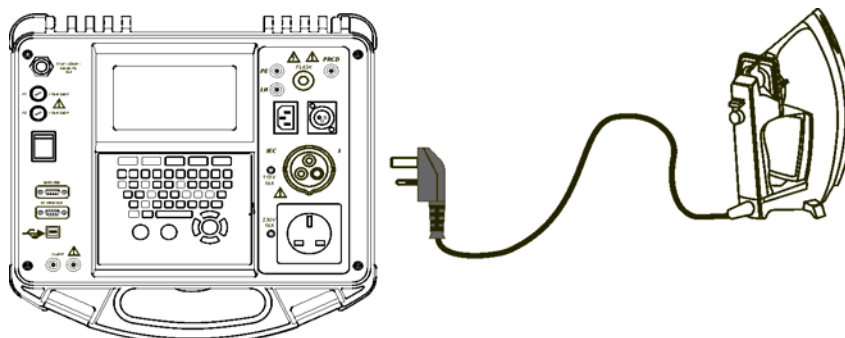
Notes:

- Consider any displayed warning before starting measurement!
- Substitute leakage current may differ substantially from that of conventional leakage current test because of the way the test is performed. For example, the difference in both leakage measurements will be affected by the presence of neutral to earth noise suppression capacitors.

6.4 Leakage current and power

The purpose of this test is to determine the sum of all leakages flowing from the live conductor to the earth. Because the differential method for determining leakage current is used the full and true appliance leakage current is always measured, even when parallel current paths to ground exist in the appliance.

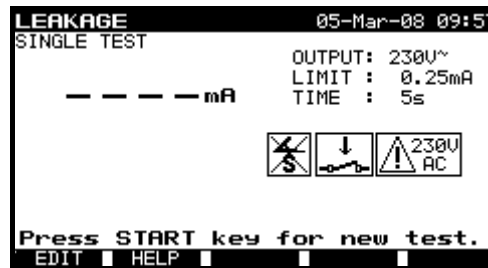
The apparent power of the appliance is also measured at the same time as leakage current. By checking the power an efficient functional test can be performed.



Measuring of leakage current and power

6.4.1 How to perform single leakage current measurement

From the **Main menu**, select **Single test** and then select **Leakage** by using $\uparrow$ and $\downarrow$ cursor keys and press ENTER key to confirm. **Leakage menu** is displayed.



Leakage menu

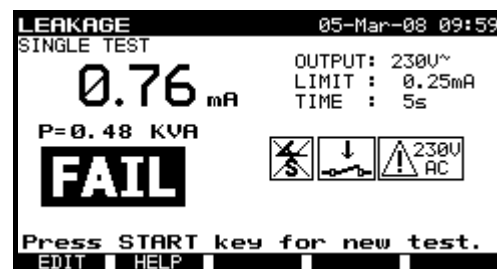
Measurement parameters are detailed in the upper right corner of the display. The following parameters can be adjusted for this measurement:

- high limit leakage value,
- measurement duration.

To edit parameters press F1 function key first. Use $\uparrow$ and $\downarrow$ cursor keys to select the parameter you want to edit. By using $\leftarrow$ and $\rightarrow$ cursor keys adjust the selected parameter. Press F1 function key again to confirm the selected settings.

Press the START key to perform a measurement.

The measurement can be aborted by pressing STOP key at any time. Actual result is shown on the display during measurement. After measurement time period has elapsed the last measured value is displayed, and PASS or FAIL indication appears on the display (based on the high limit leakage value).



Examples of leakage current and apparent power measurement results

Press START key to repeat the test or press ESC key to return to the **Single test menu**.

Notes:

- During the test, a mains voltage is connected to the appliance. If appliance contains moving parts, make sure that it is safely mounted or protected to prevent possible danger to the operator or damage to the appliance or surrounding environment!
- Consider any displayed warning before starting measurement!

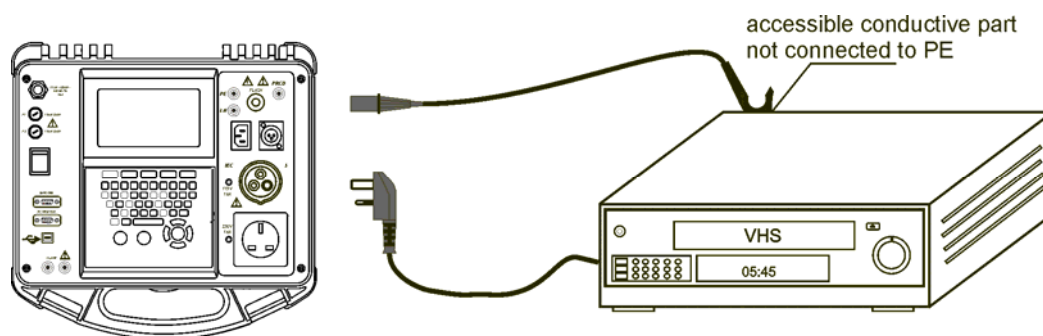
6.5 Touch leakage current

This test determines the current that would flow if a person touches the appliance.

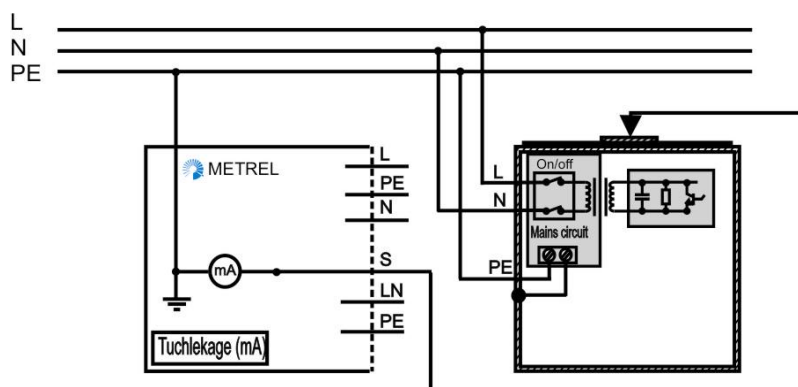
Measurement is based on a human body model with resistance of 2 k Ω . Both AC and DC components of touch leakage current are detected.

The instrument measures the leakage current flowing through the S probe into earth.

The appliance under test can be powered from the mains test socket or directly from the installation (fixed installed equipment).



Measurement of touch leakage current



Measurement of touch leakage current on a fixed installed appliance

6.5.1 How to perform single touch leakage current measurement

From the **Main menu**, select **Single test** and then select **Touch leakage** by using $\blacktriangle$ and $\blacktriangledown$ cursor keys and press ENTER key to confirm. **Touch leakage menu** is displayed.



Touch leakage menu

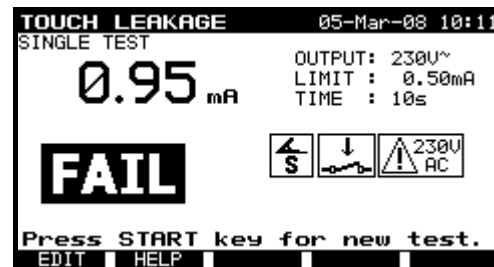
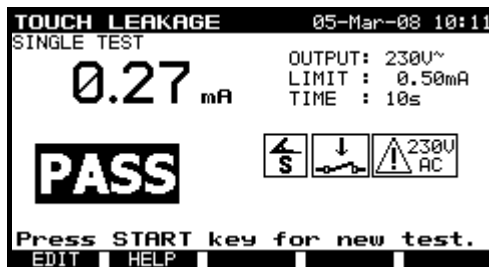
Measurement parameters are detailed in the top right corner of the display. The following parameters can be adjusted in this measurement:

- high limit leakage value,
- measurement duration.

To edit parameters press F1 function key first. Use ▲ and ▼ cursor keys to select the parameter you want to edit. By using ◀ and ▶ cursor keys adjust the selected parameter. Press F1 function key again to confirm the selected settings.

Press the START key to perform a measurement.

The measurement can be aborted by pressing STOP key at any time. The actual result is shown on the display during the measurement. After the measurement time period has elapsed the last measured value is displayed, and PASS or FAIL indication appears on the display (based on the high limit leakage value).



Examples of touch leakage current measurement results

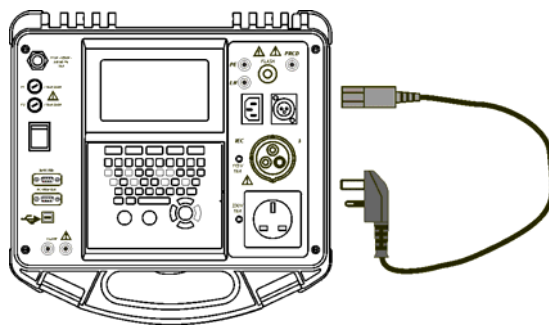
Press START key to repeat the test or press ESC key to return to the **Single test menu**.

Notes:

- During the test, a mains voltage is connected to the appliance. If appliance contains moving parts, make sure that it is safely mounted or protected to prevent possible danger to the operator or damage to the appliance or surrounding environment!
- Consider any displayed warning before starting measurement!

6.6 Polarity test

This test checks the polarity of a mains supply cable. The following faults can be detected: L open, N open, PE open, L-N crossed, L-PE crossed, N-PE crossed, L-N shorted, L-PE shorted, N-PE shorted, multiple faults.



Polarity test of IEC cord

6.6.1 How to perform the measurement

From the **Main menu**, select **Single test** and then select **Polarity test** by using $\blacktriangle$ and $\blacktriangledown$ cursor keys and press ENTER key to confirm. **Polarity test menu** is displayed.



Polarity test menu

Connect the lead between the IEC port of the PAT tester and the mains test socket.

Press START key to perform test.

After performing the test PASS or FAIL indication appears on the display. In the case of a FAIL result the detected fault is displayed.



Examples of polarity test results

Press START key to repeat the test or press ESC key to return to the **Single test menu**.

Note:

- › Consider any displayed warning before starting test!
- › This test is only for use on IEC cables and extension cables.
- › When testing extension cables, a route back to the IEC port of the instrument must be made otherwise the test will fail.

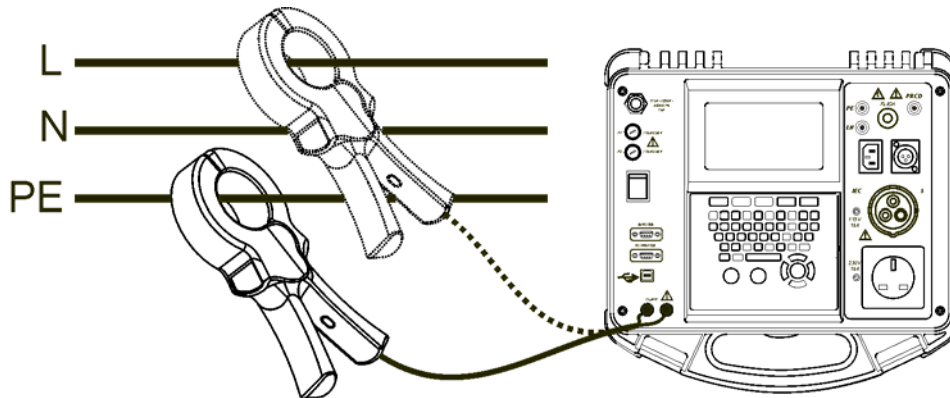
6.7 TRMS current measurement using clamp current adapter

This function enables the measurement of AC currents in a wide range from 1 mA up to 25 A. Typical applications are:

- measuring leakage currents through PE conductor in permanently installed appliances,
- measuring load currents through L or N conductor in permanently installed appliances,
- measuring leakage currents through parallel current paths, etc.

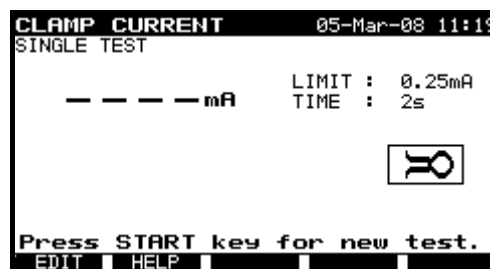
6.7.1 How to perform TRMS current measurement using clamp current adapter

In order to measure a true RMS current connect the current clamp to the instrument CLAMP connector first.



Connecting current clamp to the BetaPAT instrument

From the **Main menu**, select **Single test** and then select **Clamp current** by using $\blacktriangle$ and $\blacktriangledown$ cursor keys and press ENTER key to confirm. **Clamp current menu** is displayed.



Clamp current menu

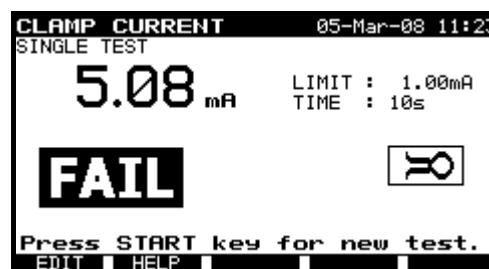
Measurement parameters are detailed in the top right corner of the display. The following parameters can be adjusted in this measurement:

- high limit current value,
- measurement duration.

To edit parameters press F1 function key first. Use ▲ and ▼ cursor keys to select the parameter you want to edit. By using ◀ and ▶ cursor keys adjust the selected parameter. Press F1 function key again to confirm the selected settings.

Press the START key to perform a measurement.

The measurement can be aborted by pressing STOP key at any time. The actual result is shown on the display during the measurement. After the measurement time period has elapsed the last measured value is displayed, and PASS or FAIL indication appears on the display (based on the high limit current value).



Examples of clamp current measurement results

Press START key to repeat the measurement or press ESC key to return to the **Single test menu**.

Notes:

- › Consider any displayed warning before starting measurement!
- › When measuring leakages neighbor magnetic fields and capacitive coupling (especially from the L and N conductors) can disturb the results. It is recommended that the clamp is as close as possible to the grounded surface and away from wires and other objects under voltage or carrying current
- › Use test clamp supplied by METREL or other with similar characteristics (current output, ratio 1000:1, appropriate measurement range; consider error of test clamp when evaluating measured results)!

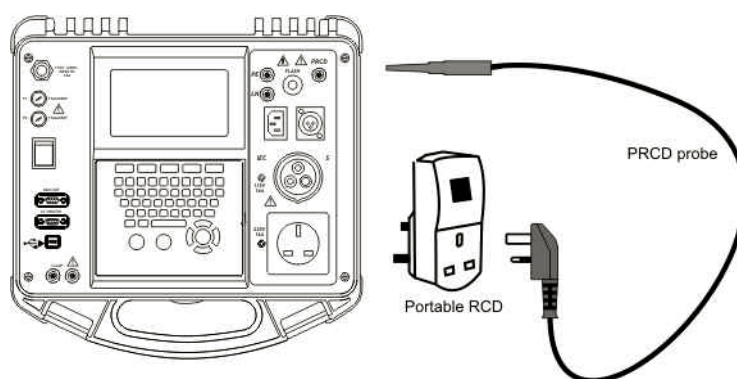
6.8 RCD test

The purpose of this test is to ensure the proper operation of residual current devices built into an appliances and portable residual current devices.

6.8.1 RCD test on appliances

For the RCD test the appliance must be plugged in the main test socket and the PRCD test probe must be used. Depending on the type of PRCD, it may be necessary to manually switch the PRCD on.

During the test the instrument simulates a fault current between the RCDs L (line) output and the instruments PRCD socket.

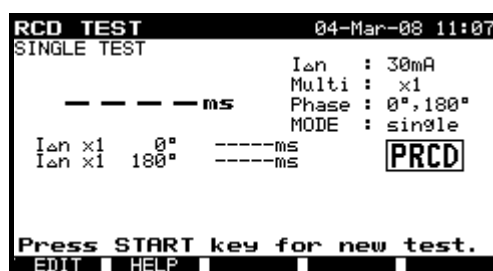


Testing of portable RCD

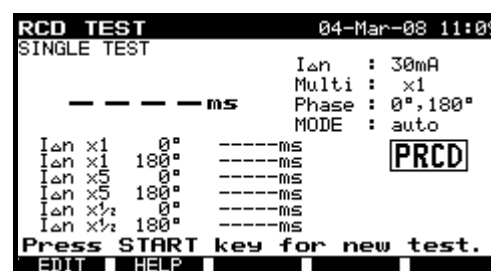
First connect portable RCD unit into the test socket. Then connect PRCD test probe to the portable RCD unit and the other end of PRCD probe to the PRCD socket of the instrument.

6.8.2 How to perform an RCD test

From the **Main menu**, select **Single test** and then select **RCD test** by using $\blacktriangle$ and $\blacktriangledown$ cursor keys and press ENTER key to confirm. **RCD menu** is displayed.



RCD single test menu



RCD autotest menu

Measurement parameters are detailed in the top right corner of the display. The following parameters can be adjusted in this measurement:

- nominal test current value,
- test current size (multiplier),
- test current starting polarity,
- test mode.

To edit the parameters, press the F1 function key first. Use $\blacktriangle$ and $\blacktriangledown$ cursor keys to select the parameter you want to edit. By using $\blacktriangleleft$ and $\blacktriangleright$ cursor keys adjust the selected parameter. Press F1 function key again to confirm the selection.

Nominal test current $I_{\Delta N}$

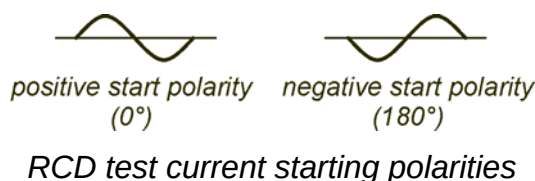
The nominal test current can be set to 10mA, 15mA and 30mA. These are the typical values for portable RCDs.

Test current size (multiplier)

The RCD functional standards define maximal allowed trip out times (see *chapter 3.8 Technical specifications*) at current values $I_{\Delta N}$ and $5 \times I_{\Delta N}$. At $\frac{1}{2} \times I_{\Delta N}$ the RCD must not trip out.

Starting polarity

The RCD test must be performed at two different residual current starting polarities (0° and 180°). This is necessary because the sensitivity of some RCDs depends on the polarity of the residual current.

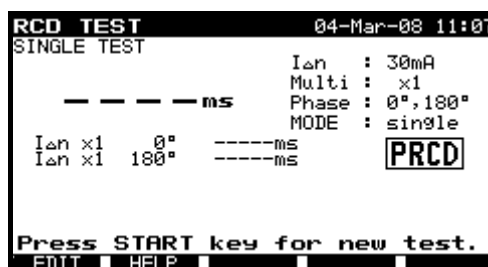
**Test mode**

In the **RCD single test** mode the RCD operation is checked at the user-defined test conditions. The purpose of this test is to perform a fast RCD operation check.

In the **RCD autotest** the RCD operation is checked at all current multipliers. The purpose of this test is to perform a complete test of the RCD operation.

6.8.3 How to perform RCD single test

Enter **RCD single test menu** as described in chapter 6.8.2 *How to perform an RCD test*.



RCD single test menu

For the RCD test the appliance must be plugged in the instrument's main test socket and the PRCD test probe must be connected.

Step 1

Instrument displays the message »Press START key for new test.«.

After setting the parameters, press the START key to apply a voltage to the main test socket.

Step 2

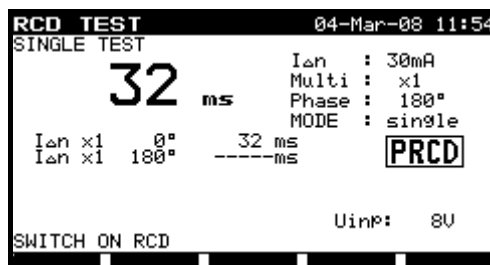
The instrument displays the message »RCD ON and press START key to proceed«.

Check that the RCD is switched ON (most of portable RCDs must be manually switched on after they plugged in) and the PRCD test probe is connected

properly between the PRCD socket of the instrument and the mains connections of the RCD (as illustrated in chapter **6.8.1 RCD test on appliance**).

The conditions for performing the test are fulfilled when the displayed voltage indication shows that a voltage is applied.

Press the START key to begin the 1st test ($I_{\Delta N}$, 0°). The measurement normally trips an RCD within the allowed time period. The following menu is displayed:



Example of RCD test result

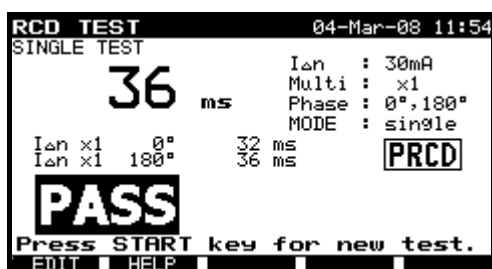
Step 3

Reset the RCD.

The instrument automatically proceeds with the 2nd test ($I_{\Delta N}$ x1, 180°).

The test passes if the RCD trips inside the predefined limits on both polarities. If this is the case, a PASS indication will be displayed.

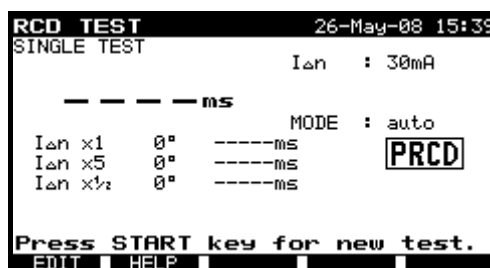
The measurement can be aborted at any time by pressing ESC key.



Examples of RCD single test results

6.8.4 How to perform RCD auto test

Enter RCD auto test menu as described in chapter **6.8.2 How to perform an RCD test**.



RCD auto test menu

For the RCD test the appliance must be plugged in the instrument's main test socket and the PRCD test probe must be connected.

Step 1

Instrument displays the message »Press START key for new test.«.

After setting the parameters, press the START key to apply a voltage to the main test socket.

Step 2

The instrument displays the message »RCD ON and press START key to proceed.«.

Check that the RCD is switched ON (most of portable RCDs must be manually switched on after they plugged in) and the PRCD test probe is connected properly between the PRCD socket of the instrument and the mains connections of the RCD (as illustrated in chapter **6.8.1 RCD test on appliance**).

The conditions for performing the test are fulfilled when the displayed voltage indication shows that a voltage is applied.

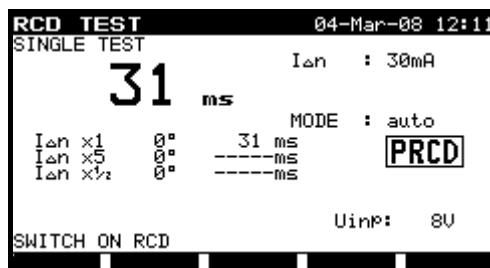
The autotest sequence starts to run as described in the following steps.

Step 3

Trip-out time measurement with the following measurement parameters:

- › test current of $I_{\Delta N}$,
- › test current started with the positive half-wave (from 0^0).

The measurement normally trips an RCD within the allowed time period. The following menu is displayed:



RCD auto test result example ($I_{\Delta N}$, 0^0)

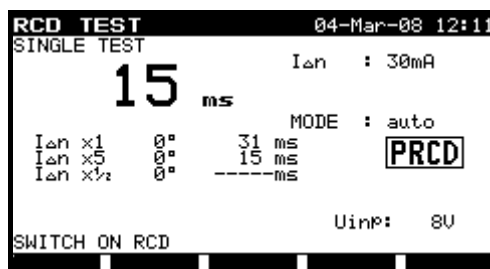
After resetting the RCD, the autotest sequence automatically proceeds with the next step.

Step 4

Trip-out time measurement with the following measurement parameters:

- › test current of $5 \times I_{\Delta N}$,
- › test current started with the positive half-wave (from 0^0).

The measurement normally trips an RCD within the allowed time period. The following menu is displayed:



RCD auto test result example ($5 \times I_{\Delta N}$, 0°)

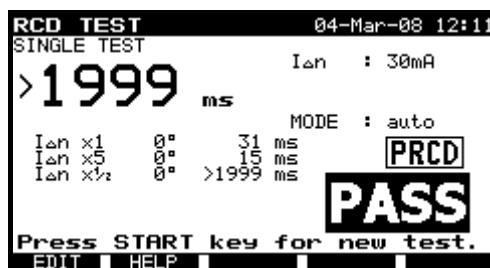
After resetting the RCD, the autotest sequence automatically proceeds with the next step.

Step 5

Trip-out time measurement with the following measurement parameters:

- › test current of $\frac{1}{2} \times I_{\Delta N}$,
- › test current started with the positive half-wave (from 0°).

Measurement does **NOT** normally trip an RCD. The following menu is displayed after an autotest sequence has been completed:



RCD autotest results

The test passes if the RCD:

- › does not trip out at $\frac{1}{2} \times I_{\Delta N}$ tests,
- › trips within the predefined limits at $I_{\Delta N}$, and $5 \times I_{\Delta N}$ tests and a PASS indication is displayed.

If all of these conditions have been met, a PASS indication is displayed.

The measurement procedure can be aborted at any time by pressing ESC key.

Notes:

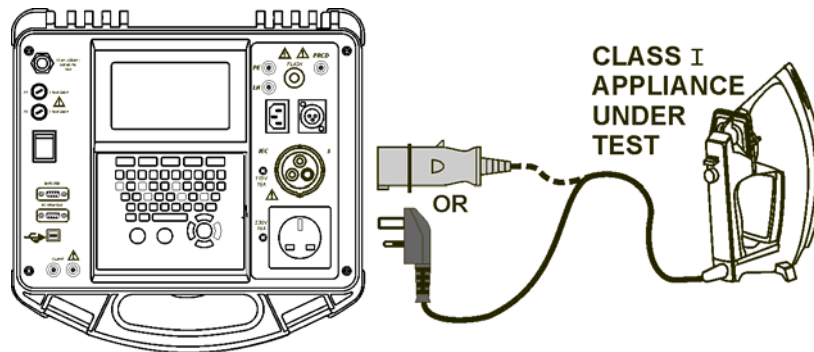
- › Consider any displayed warning before starting measurement!
- › For appliances with integrated RCD the housing must be opened to access the RCD's L output terminal (this should only be performed by a competent engineer).
- › Mains voltage is applied to the device under test. Do not touch the equipment under test or the test leads during the test.

6.9 Flash test (MI 3305 – OmegaPATPlus only)

The purpose of this test is to ensure that the insulation material of the appliance can withstand high voltage transients and short overvoltages.

6.9.1 Flash test on class I appliances

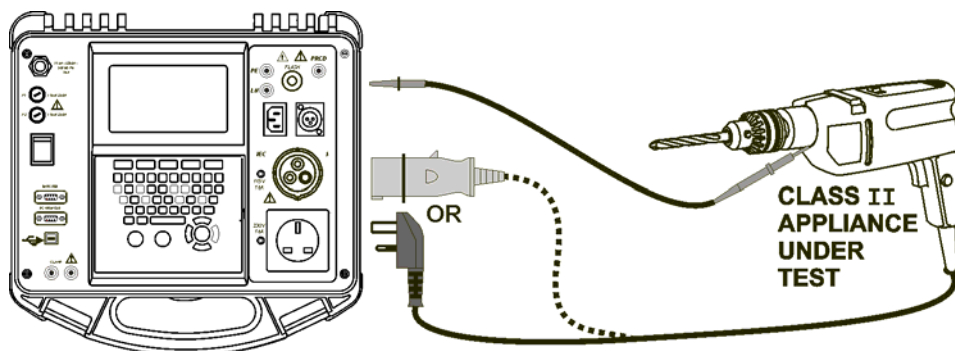
For Class I appliances, a test voltage of 1.5 kV_{AC} is applied between main test socket (L+N) and PE test terminals.



Flash test on Class I appliance

6.9.2 Flash test of class II appliances

For Class II appliances, a test voltage of 3 kV_{AC} is applied between main test socket (L+N) and FLASH test terminals.



Flash test on Class II appliance

6.9.3 How to perform single Flash measurement

From the **Main menu**, select **Single test** and then select **Flash test** by using $\blacktriangle$ and $\blacktriangledown$ cursor keys and press ENTER key to confirm. **Flash menu** is displayed.



Flash test menu

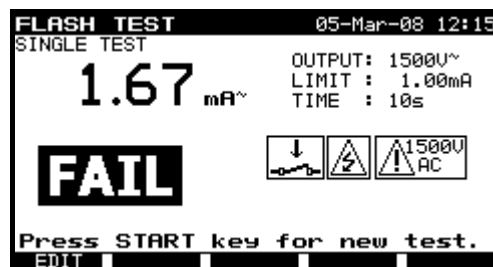
The measurement parameters are detailed in the top right corner of the display. The following parameters can be adjusted in this measurement:

- › output voltage value,
- › current limit value,
- › measurement duration.

To edit parameters, press F1 function key first. Use ▲ and ▼ cursor keys to select the parameter you want to edit. By using ◀ and ▶ cursor keys adjust the selected parameter. Press F1 function key again to confirm the selected settings.

Press the START key to perform a measurement.

The measurement can be aborted by pressing STOP key at any time. The actual result is shown on the display during the measurement. In case, that current limit is exceeded during the test, measurement is aborted immediately. After the measurement time has elapsed or aborted the last measured value is displayed, and PASS or FAIL indication appears on the display (based on the current limit leakage value).



Examples of flash test results

Press START key to repeat the test or press ESC key to return to the **Single test menu**.

Notes:

- › Consider any warning on the display before starting measurement.
- › Do not touch the equipment under test or the test leads during the test – a dangerous voltage will be present.
- › Appliance ON/OFF switches must be switched on.
- › Before applying the test, check that the components in the appliance can withstand the test voltage without any damage. IT appliances are especially sensitive.

7 Autotest sequences

Autotest is the fastest and easiest way to test appliances. A pre-programmed autotest sequence runs all the tests needed for verifying that the selected appliance is safe to use. The complete autotest results can be stored together with their associated appliance name and all related information.

7.1 Autotest shortcut menu

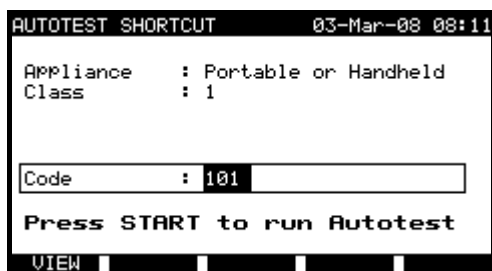
In this autotest menu any of the pre-defined autotest procedures can be selected. Pre-programmed sequences cover almost all *in-service* tests, regardless of appliance type and safety class.

All limits and tests are in compliance with currently valid standards and regulations. In case of any changes, new firmware will be available at your distributor or from Metrel directly.

The Autotest shortcut sequences depend on the OmegaPATPlus / BetaPATPlus model. The complete list of autotest shortcut sequences can be found in Appendices A and B of this manual.

7.1.1 Selecting the autotest shortcut sequence

From the **Main menu** select **Autotest shortcut** by using $\blacktriangle$ and $\blacktriangledown$ cursor keys, and press ENTER key to confirm. **Autotest shortcut menu** is displayed.



Aus/NZ model



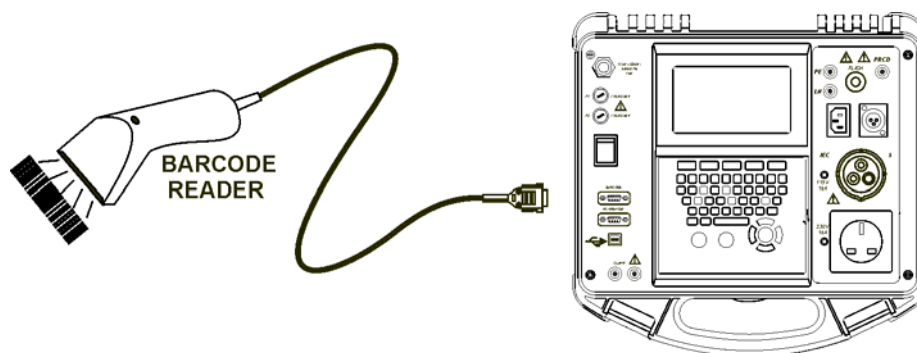
UK model

Autotest shortcut menu examples

The autotest sequence can simply be selected with three-digit test code using $\blacktriangleleft$ and $\blacktriangleright$ cursor keys or entering three-digit code by numeric keypad.

If the appropriate test code is unknown, the appliance sequence can be selected based on the appliance type and safety class. To set the autotest sequence code or appliance parameters, first use $\blacktriangle$ and $\blacktriangledown$ cursor keys to select the parameter you want to edit. The $\blacktriangleleft$ and $\blacktriangleright$ cursor keys can then be used to adjust the selected parameter.

The three-digit autotest code can also be selected by using the barcode reader. In this case connect barcode reader to the DB-9 female BARCODE connector first.



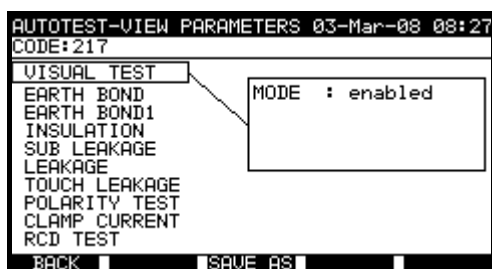
Connecting barcode reader to the BetaPAT instrument

The code read from the barcode label is accepted when two short beeps are emitted.

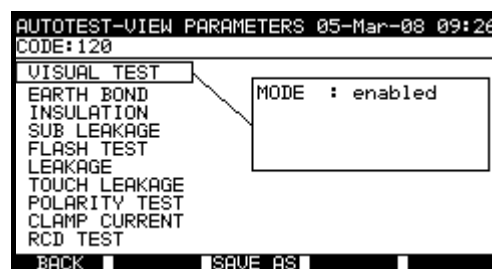
All test parameters and limits can simply be viewed on the display. For more information refer to chapter **7.1.2 How to view autotest shortcut sequence measurement parameters**.

7.1.2 How to view autotest shortcut sequence measurement parameters

After pressing the F1 function key in **Autotest shortcut menu** the measurement parameters of the selected autotest sequence are detailed.



Aus/NZ model



UK model

Autotest shortcut view menu

By using $\blacktriangle$ and $\blacktriangledown$ cursor keys, the parameters of the selected measurement can be viewed.

The following measurement parameters can be viewed in all measurements:

- measurement mode,
- output test voltage or current (except in visual test and TRMS current measurement),
- pass level (except in visual test),
- measurement duration (except in visual test).

When **mode** is set to **disable**, the selected measurement is skipped.

When **mode** is set to **single**, one measurement will be performed during the autosequence.

When **mode** is set to **continuous**, up to five repetitive measurements can be performed (except earth bond measurement where up to six).

Visual test and polarity test can only be **enabled** or **disabled**. If **enable** mode is selected, visual test/polarity test can be performed.

Press ESC key to return to the **Autotest shortcut menu**.

7.1.3 How to start autotest shortcut sequence

An autotest can be started from the **Autotest shortcut menu** by following a simple procedure:

In **Autotest shortcut menu**, select the test sequence to be executed (see **7.1.1 Selecting the autotest shortcut sequence**). Press the START key to start the autotest sequence. Refer to chapter **7.4 Performing autotest sequences** for more information.

7.2 Autotest custom menu

The autotest custom menu allows the setting and of editing user-defined autotest procedures. Eight customizable autotest sequences with all measurements disabled are added to the list by default and can be set to the users needs. They can be restored to default settings by selecting **Original settings** in **Setup menu**.

Up to 50 customizable autotest sequences can be pre-programmed in this autotest mode.

An alternative is to pre-program the sequences in the PATLink PRO PC software and uploading them to the instrument. Refer to chapter **9.2 Data upload / download** for more information.

Use ▲ and ▼ cursor keys in **Main menu** to select **Autotest custom** and press ENTER key to confirm. The **Autotest custom menu** is displayed.



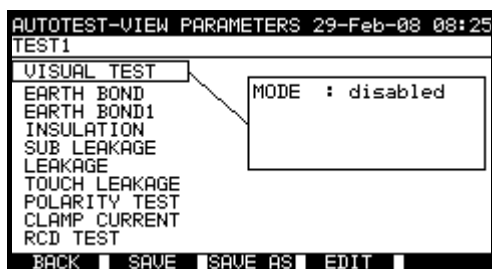
Autotest custom menu

Note:

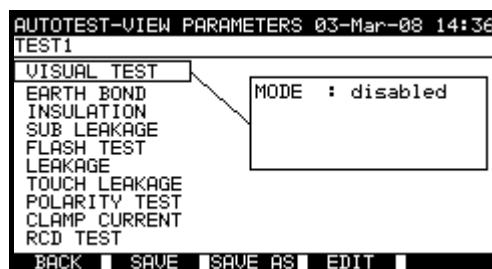
- If more than 50 autotests are saved, the »Out of memory« message is displayed.

7.2.1 How to view and/or change an existing autotest custom sequence

By using ▲ and ▼ cursor keys in **Autotest custom menu** select the autotest sequence you want to view and/or change and press ENTER key to confirm. **Autotest custom view menu** is displayed.



Aus/NZ model



UK model

Autotest custom view menu

Depending on the measurement the following measurement parameters can be set here:

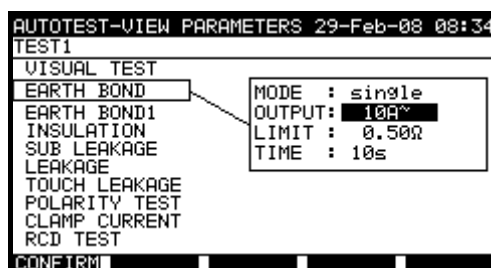
- measurement mode,
- output test voltage or current (except in visual test and TRMS current measurement),
- pass level (except in visual test),
- measurement duration (except in visual test).

When **mode** is set to **disable**, the selected measurement is skipped.

When **mode** is set to **single**, one measurement will be performed during the autosequence.

When **mode** is set to **continuous**, up to five repetitive measurements can be performed (except earth bond measurement where up to six).

By using $\uparrow$ and $\downarrow$ cursor keys in **Autotest custom view menu** select the measurement you want to edit. Press the F1 function key to enable parameters editing of selected measurement. Use $\uparrow$ and $\downarrow$ cursor keys to select parameter you want to edit. Then use $\leftarrow$ and $\rightarrow$ cursor keys to adjust selected parameter.



Adjusting measurement parameters

Press F1 function key to accept the new settings for selected measurement. The instrument will then return to **Autotest custom view menu**.

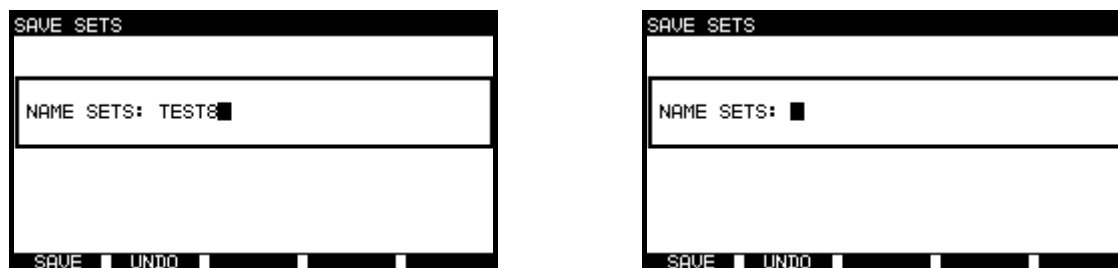
Once the parameters for all the required measurements have been set, existing autotest sequence can be saved under the same name or renamed. Also new autotest sequence can be added to the list. Refer to chapter **7.2.2 How to save the autotest custom sequence**.

7.2.2 How to save the autotest custom sequence

In the **Autotest save menu**, the following actions can be taken:

- › an existing autotest sequence can be saved or renamed,
- › a new autotest sequence can be added to the list.

In **Autotest custom view menu** press F2 function key to save or rename the edited autotest sequence or press F3 function key to add a new autotest sequence to the list. The **Autotest save menu** is displayed.



Autotest custom save menus

When saving or renaming an autotest sequence, the existing name of the selected custom procedure is shown in **Name sets** field. Up to 17 alpha-numeric and special characters can be entered in **Name sets** field. Press ESC key to return **Autotest custom menu**.

After the autotest name has been entered, press the F1 function key for confirm or the ESC key to return to the **Autotest custom menu**. To restore last used name press F2 function key.

7.2.3 How to delete an existing custom test sequence from the list

In **Autotest custom menu**, select the test sequence you want to delete by using ▲ and ▼ cursor keys. Press the F3 function key to delete. Confirm the delete by pressing the Y key. The selected autotest sequence will then be deleted from the list.

Notes:

- › The first custom autotest sequence cannot be deleted from the list.
- › If only one custom autotest is defined, it cannot be deleted from the list!

7.2.4 How to start custom autotest sequence

An autotest can be started from the **Autotest custom menu** by following a simple procedure:

In **Autotest custom menu**, select the test sequence to be executed (see **7.1.1 Selecting the autotest shortcut sequence**). Press the START key to start the autotest sequence. Refer to chapter **7.4 Performing autotest sequences** for more information.

7.3 Project autotests

The **Project autotests** is a unique tool that dramatically simplifies and speeds up repeated (periodic) testing of appliances.

The main idea is to re-use known stored data (either in instrument or on a PC) of the tested appliance. The following data can be recalled from the instrument's memory and re-used:

Test sequence

If the sequence has not changed (this is usually the situation) the user does not need to care about setting the right test sequence and parameters.

Appliance data

ID number, names, descriptions, addresses, comments are not needed to be re-entered again. Old data are offered by default.

Old test results

Actual Project Autotest test results can be compared with previous results. The instrument automatically calculates the trends for each measurement.

Note:

- If the test results are close to the limit they should be compared with old test results. If the trends are deteriorating, the safety of the appliance and the time between test should be reassessed. If the results stay stable the appliance can generally be treated as safe.

Old test results can be uploaded from a PC back to the instrument. This brings further advantages:

- old test results are not occupying the instrument's memory and can be temporarily uploaded only for the purpose of re-testing,
- test results and appliance data can be moved / shared among different test instruments,
- appliance data can be pre-entered on the computer and then sent to the instrument.

7.3.1 How to select a project autotest

The first step when performing project autotests is to recall the appropriate stored appliance data from the instruments memory. The procedure is similar as if test results are to be recalled from the instrument's memory.

In the **Main menu** select **Project autotests** by using ▲ and ▼ cursor keys and press ENTER key to confirm. **Search project autotest menu** will be displayed.



Aus / NZ model



UK model

Project autotests main menu

When searching for stored autotest results the following filters can be used to narrow the hits:

UK model

- appliance number,
- test site,
- location
- date from and date to,
- user.

Aus / NZ model

- appliance number,
- building
- room,
- date from and date to,
- user.

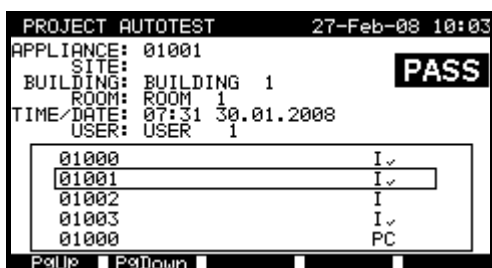
By using $\uparrow$ and $\downarrow$ cursor keys select the filter you want to edit.

To change the selected parameter line type, press the F3 function key and the »parameter type« will become highlighted (e.g. APPLIANCE). The $\leftarrow$ and $\rightarrow$ cursor keys can then be used to change the parameter type and by pressing ENTER key the choice can be confirmed. Once the parameter types have been set up, the data required to filter the files can be inserted. Filter information can be inserted via the alphanumeric keypad or, in some filter fields such as user, can also be selected from a predefined list by pressing the F4 function key. The appliance number field can also be read using a barcode reader.

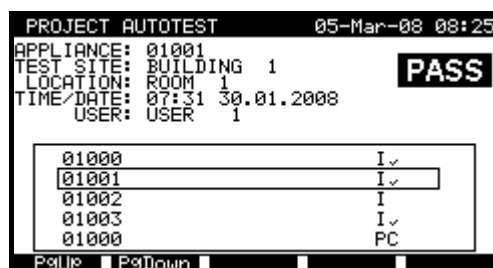
By placing a »*« (shift + "2") in a particular field, tells the instrument not to search the associated filter field. When searching, the instrument will therefore ignore data in this parameter and go on to find all the appliances that conform to data placed in the other filter fields.

To find all stored results, enter »*« in the all fields (excluding DATE where the correct from and to dates must be entered).

When the search filters have been correctly set up, a search can be performed by pressing the F1 function key. If the search filters are set up correctly and the appliances exist in the units memory, the **Project autotests result** menu will be displayed.



Aus/ NZ model



UK model

Project autotest result menu

While recalling stored results, the instrument shows a bargraph and a ratio of files found compared to files stored in memory (e.g. 7/11 implies 7 results have been found to meet the filter criteria out of a potential 11 results stored in the flash memory).

By using ▲ and ▼ cursor keys, the F1 and F2 function keys or barcode reader, select the appliance that should be retested.

Appliance tickers

Each appliance is marked with a ticker. The ticker appears at the right of the appliance number and helps to speed up finding appliances to be retested.

The meaning of the tickers is as follows:

- PC** The stored appliance data was uploaded from PC
- PC✓** The stored appliance data was uploaded from PC and has been retested
- I** The stored appliance data was performed with the instrument and stored.
- I✓** The stored appliance data was performed with the instrument and stored and has been retested.

By pressing ENTER key on an appliance, more information regarding the appliance results and data can be viewed. The information can be scrolled using the F1 and F2 function keys and the F5 function key can be used to switch between different appliance data views.

RECALL MEMORY 28-Feb-08 11:36				
APPLIANCE: 0045771944				
SITE: PASS				
BUILDING: METREL				
ROOM: CONFERENCE ROOM				
FUNCTIONS	PARAMETERS	LIMIT	RESULTS	S
VISUAL				
EARTH BOND	10A~	3.00Ω	1.76Ω	P
EARTH BOND1	200mA~	0.00Ω	0.74Ω	P
INSULATION	250V~	10.00MΩ	44.9MΩ	P
SUB LEAKAGE	40V~	10.50mA	0.48mA	P
LEAKAGE	230V~	3.00mA	0.98mA	P

Aus/NZ model

RECALL MEMORY 05-Mar-08 08:27				
APPLIANCE: 0045771944				
TEST SITE: METREL				
LOCATION: CONFERENCE ROOM				
USER: USER 1				
FUNCTIONS	PARAMETERS	LIMIT	RESULTS	S
VISUAL				
EARTH BOND	10A~	3.00Ω	1.76Ω	P
EARTH BOND1	200mA~	0.00Ω	0.74Ω	P
INSULATION	250V~	10.00MΩ	44.9MΩ	P
SUB LEAKAGE	40V~	10.50mA	0.48mA	P
LEAKAGE	230V~	3.00mA	0.98mA	P

UK model

View results menu examples

Use ESC key to return to previous menu.

7.3.2 How to start a project autotest

From the **Main menu**, select **Project autotest**. Using the filters, search for the appliances to be retested. To retest a particular appliance, find the appliance by using the ▲ and ▼ cursor keys, the F1 and F2 function keys or the barcode reader and begin retesting the appliance by pressing the START key.

If the appliance is new, a standard autotest can be performed as described in 7.4

Performing autotest sequences:

- the autotest sequence will be the same as it was for the selected Project autotest.
- exactly the same appliance data (except time and user) will be offered to store in the selected Project autotest.
- when a new autotest is saved, it will get an »I« ticker. The original autotest will get a »I✓« ticker when the appliance is retested through the project autotest.

7.3.3 Compare of results (evaluation of result trends)

If an autotest sequence was performed from the Project autotests menu, an additional option TREND is offered in the **View result** menu after the autotest is finished.

VIEW RESULTS				
28-Feb-08 11:44				
APPLIANCE: 0045771944				
SITE: PASS				
BUILDING: METREL				
ROOM: CONFERENCE ROOM				
FUNCTIONS	PARAMETERS	LIMIT	RESULTS	S
VISUAL				
EARTH BOND	10A~	3.00Ω	0.69Ω	
EARTH BOND1	200mA~	3.00Ω	0.74Ω	
INSULATION	250V~	10.00MΩ	14.01MΩ	
SUB LEAKAGE	40V~	3.50mA	0.36mA	
LEAKAGE	230V~	3.00mA	1.73mA	
PgUp PgDown TREND MORE				

View Project autotest results menu

In the Save results window, press the F4 (VIEW) key the results to enter the view results window. By pressing the F4 button again (TREND) a comparison between the old and new test data will be performed. This is a very useful feature to evaluate result trends in cases where results are relatively close to the limit.

COMPARE RESULTS				
28-Feb-08 11:41				
APPLIANCE: 0045771944				
OLD: 27/02/2008 - PASS				
NEW: 28/02/2008 - PASS				
PASS				
FUNCTIONS	OLD	NEW	TREND	
EARTH BOND	1.76Ω	0.69Ω	↑	
EARTH BOND1	0.74Ω	0.74Ω	○	
INSULATION	44.9MΩ	14.01MΩ	↓	
SUB LEAKAGE	0.48mA	0.36mA	↑	
LEAKAGE	0.98mA	1.73mA	↓	
POWER	0.48KVA	0.69KVA	↓	
PgUp PgDown RESULT				

Compare results menu example

Meaning of trend symbols:

- ↑ New result of particular test is better than last result.
 Examples: New insulation resistance result is higher than old result.
 New earth bond result is lower than old one.
- Difference between old and new result of particular test is so small that can be treated as the same.
 Example: New insulation resistance result stays at the same level as old result.
- ↓ New result of particular test is worse than last result.
 Examples: New insulation resistance result is lower than old result.
 New earth bond result is higher than old one.

By using F1 and F2 function keys all measurements can be compared. Use F5 key to return to **View result menu**.

7.4 Performing autotest sequences

7.4.1 Visual inspection

During a visual inspection of an appliance damage to the following items should be identified:

- ▶ appliance plug,
- ▶ appliance mains fuse,
- ▶ appliance mains lead.



Visual test menu

In case that any damage on the appliance is identified, press F3 key (FAIL) in order to identify the visual test as failed.

7.4.2 Earth bond resistance measurement

Note:

- Consider the displayed warnings before starting measurement!

If the earth bond resistance measurement passes, the instrument automatically proceeds with the next test in the sequence (in single measurement mode only). If the earth bond test fails or if the earth bond is set to continuous mode, the autotest sequence stops when the earth bond resistance measurement is performed and a prompt will appear on the screen.

The following actions can be taken to continue or complete the autotest sequence:

START	Starts the earth bond resistance measurement. Proceed with the next earth bond resistance measurement (in continuous measurement mode only). Proceed to the next autotest sequence measurement (in single measurement mode only).
F2 function key.....	View the earth bond test help screens.
F3 function key	Repeat the earth bond resistance measurement.
ENTER key	Proceed to the next autotest sequence measurement (in continuous measurement mode only).
F4 function key	Skip earth bond resistance measurement.
F5 function key	End the autotest sequence.

Notes:

- For class II appliances the test probe should be used (see chapter **6.2.2 *Insulation resistance on class II appliances***)!
- Consider the displayed warnings before starting measurement!

If the insulation measurement fails or the test is set to continuous measurement mode, the autotest sequence stops and a prompt will appear on the screen (in continuous measurement mode only).

START	Start the insulation resistance measurement. Proceed with the next insulation resistance measurement (in continuous measurement mode only). Proceed to the next autotest sequence measurement (in single measurement mode only).
F2 function key.....	View insulation resistance test help screens.
F3 function key	Repeat the insulation resistance measurement.
ENTER key	Proceed to the next autotest sequence measurement (in continuous measurement mode only).
F4 function key	Skip insulation resistance measurement.
F5 function key	End the autotest sequence.

Notes:

- For class II appliances the test probe should be used! (see chapter 6.3.2 ***Substitute leakage current on class II appliances***)
- Consider the warnings on the display before starting measurement!

The following actions can be taken to continue or complete autotest sequence:

START	Start the substitute leakage current measurement. Proceed with the next substitute leakage current measurement (in continuous measurement mode only). Proceed to the next autotest sequence measurement (in single measurement mode only).
F2 function key.....	View substitute leakage test help screens.
F3 function key	Repeat the substitute leakage current measurement.
ENTER key	Proceed to the next autotest sequence measurement (in continuous measurement mode only).
F4 function key	Skip substitute leakage current measurement.
F5 function key	End the autotest sequence.

Notes:

- › If any of the earth bond resistance tests, insulation resistance tests, or substitute leakage current tests fail in autotest sequence, the leakage current measurement will be prohibited from operating!
- › Consider the displayed warnings before starting or proceeding with measurements!

The following actions can be taken to continue or complete autotest sequence:

START	Start the leakage current measurement. Proceed with the next leakage current measurement (in continuous measurement mode only).
Proceed to the next autotest sequence measurement (in single measurement mode only).	
F2 function key.....	View leakage current test help screens.
F3 function key	Repeat the leakage current measurement.
ENTER key	Proceed to the next autotest sequence measurement (in continuous measurement mode only).
F4 function key	Skip leakage current measurement.
F5 function key	End the autotest sequence.

Notes:

- › If any of the earth bond resistance tests, insulation resistance tests, substitute leakage current test or leakage current test fail or were skipped in selected autotest sequence, the touch leakage current measurement will be prohibited!
- › When measuring touch leakage current on appliances, the earth bond test probe must be used (see section **6.5 Touch leakage current**)!
- › Consider the warnings on the display before starting measurement!

The autotest sequence stops after performing a touch leakage current measurement. The following actions can be taken to continue or complete autotest sequence:

START	Start the touch leakage current measurement. Proceed with the next touch leakage current measurement (in continuous measurement mode only). Proceed to the next autotest sequence measurement (in single measurement mode only).
F2 function key.....	View touch leakage test help screens.
F3 function key	Repeat the touch leakage current measurement.
ENTER key	Proceed to the next autotest sequence measurement (in continuous measurement mode only).
F4 function key	Skip touch leakage current measurement.
F5 function key	End the autotest sequence.

The autotest sequence stops after the RCD test.

The following actions can be taken to continue or complete the autotest sequence:

START Start the RCD test.

Proceed to the next autotest sequence measurement.

F2 function key View help screens.

F3 function key Repeat the RCD test.

F4 function key Skip the RCD test.

F5 function key End the autotest sequence.

8 Working with autotest results

After the autotest sequence is completed, measurement results can be:

- › viewed,
- › saved to the flash memory of the instrument,
- › send to PC,
- › test report can be printed out to serial printer,
- › appliance label can be printed out.

8.1 Saving autotest results

After the autotest sequence is completed, the **Save results** menu is displayed.

Aus/NZ model

UK model

Save results menu

In this menu all important data can be added to the autotest results. In the instrument, the following data can be set before saving the autotest results:

UK model

- › appliance number and its name,
- › test site and location,
- › retest period,
- › repairing code,
- › comments.

Aus / NZ model

- › appliance number and its name,
- › site, building and room,
- › retest period,
- › make,
- › comments,
- › model,
- › serial number.

By using $\blacktriangle$ and $\blacktriangledown$ cursor keys select parameter you want to edit.

Aus/NZ model

In the **Appliance no.** field, up to 10 alpha-numeric or special characters can be entered. The **Appliance number** can also be scanned with a barcode reader.

In the **Site**, **Building**, **Room** and **Appliance name** fields, up to 15 alpha-numeric or special characters can be entered. The **Building**, **Room** and **Appliance name** parameters can also be selected from the list of 100 predefined names for each parameter.

In **Retest period** field, at the most 2 numeric characters can be entered to represent the number of months between retest.

In the **Comments**, **Make**, **Model** and **Serial number** fields, up to 25 alpha-numeric or special characters can be entered.

By using F2 function key in the actual parameter line, parameter value can be reset to last accepted value. The new parameter value is accepted when the cursor is set to another parameter line.

When 2nd tag manipulation is enabled in the **Setup menu**, the 2nd appliance number and its name can be added or removed from the actual autotest results by pressing F5 function key. For the second appliance, only its name can be edited. For detailed description refer to chapter **9.3.6 Instrument settings**.

UK model

In the **Appliance no.** field up to 10 numeric characters can be entered. The **Appliance number** can also be scanned with a barcode reader.

In the **Test site**, **Location** and **Appliance name** fields, up to 15 alpha-numeric or special characters can be entered. Names can also be selected from the list of 100 predefined names for each parameter.

In **Retest period** field, at the most 2 numeric characters can be entered to represent the number of months between retest.

In **Repairing code** field, up to 20 alpha-numeric or special characters can be entered.

In the **Comments** field, up to 25 alpha-numeric or special characters can be entered.

By using the F2 function key in the actual parameter line, parameter value can be reset to the last accepted value. The new parameter value is accepted when the cursor is set to another parameter line.

All parameters added to the autotest results have, in general, a possibility to be replicated or default set to blank when saving new autotest results. Appliance number can also be automatically incremented when new autotest sequence is finished.

In **Aus / NZ model**, the 2nd appliance number and its name can also be added to the actual autotest results by pressing F5 function key. In this case, the 2nd tag manipulation has to be enabled in **Setup** menu. For detailed description refer to chapter **9.3.6 Instrument settings**.

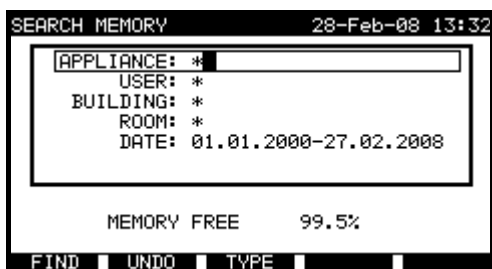
Once the information regarding the appliance has been set, the results can be saved to the flash memory of the instrument by pressing the F1 function key. Once the data has been saved, the machine emits two short beeps and the instrument returns to **Autotest** menu, if **Save & print** option in **Setup** menu is disabled. If **Save & print** option is enabled the test results can be sent to PC or printed out using serial (label) printers once the results has been saved. For detailed description refer to chapter **9.3.6 Instrument settings**.

Notes:

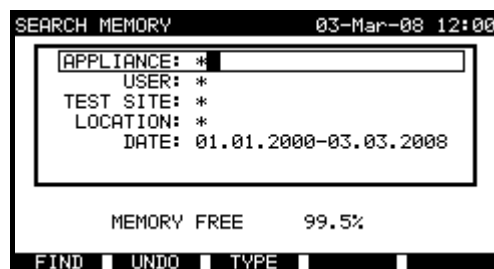
- › The date and time are automatically attached to the saved results.
- › The autotest results cannot be stored if the **Appliance no.** field is empty.
- › **User** field cannot be edited (this must be selected from the main menu of the instrument).

8.2 Recalling results

Select **Recall/delete/send memory** in **Main menu** by using ▲ and ▼ cursor keys and press ENTER key to confirm. **Search results** menu is displayed.



Aus / NZ model



UK model

Search results menu

When searching for stored results the following filters can be used to narrow the hits:

UK model

- appliance number,
- test site,
- location,
- date from and date to,
- user.

Aus/ NZ model

- appliance number,
- building,
- room,
- date from and date to,
- user.

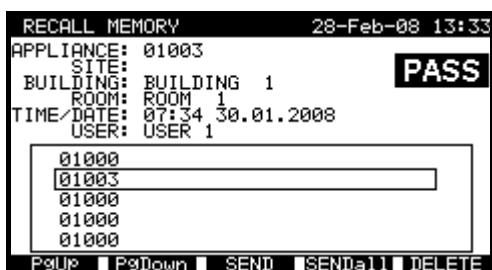
By using $\uparrow$ and $\downarrow$ cursor keys select the filter you want to edit.

To change the selected parameter line type, press the F3 function key and the »parameter type« will become highlighted (e.g. Appliance). The $\leftarrow$ and $\rightarrow$ cursor keys can then be used to change the parameter type and by pressing ENTER key the choice can be confirmed. Once the parameter types have been set up, the data required to filter the files can be inserted. Filter information can be inserted via the alphanumeric keypad or, in some filter fields such as user, can also be selected from a predefined list by pressing the F4 function key. The **Appliance number** field can also be read using a barcode reader.

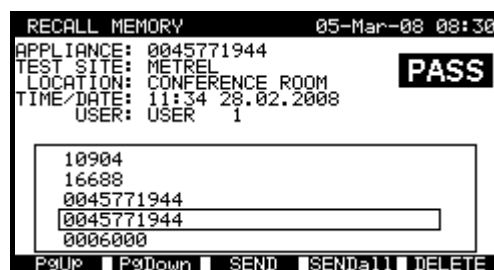
By placing a »*« (shift + »2«) in a particular field, tells the instrument not to search the associated filter field. When searching, the instrument will therefore ignore data in this parameter and go on to find all the appliances that conform to data placed in the other filter fields.

To find all stored results, enter »*« in the all fields (excluding Date where the correct from and to dates must be entered).

When the search filters have been correctly set up, a search can be performed by pressing the F1 function key. If the search filters are set up correctly and the appliances exist in the units memory, the **Recall results menu** will be displayed.



Aus/ NZ model



UK model

Recall results menu

While recalling stored results, instrument shows a bargraph and a ratio of files found compared to files stored in memory (e.g. 17/89 implies 17 results have been found to meet the filter criteria out of a potential 89 results stored in the flash memory).

Once the appliances have been found, the $\blacktriangle$ and $\blacktriangledown$ cursor keys and F1 and F2 function keys can be used to scroll through the list of appliances. More information relating to an appliance can be viewed by pressing the ENTER key on the appropriate appliance. The information can be scrolled using the F1 and F2 function keys and the F5 function key can be used to switch between different appliance data views.

RECALL MEMORY 03-Mar-08 11:55				
APPLIANCE: 5532176				
SITE:				
BUILDING: METREL				
ROOM: OFFICE 12				
		PASS		
FUNCTIONS	PARAMETERS	LIMIT	RESULTS	S
VISUAL				
EARTH BOND	10A~	1.00Ω	0.00Ω	P
INSULATION	500V~	2.00MΩ	4.51MΩ	P
PgUp PgDown MORE				

Aus/NZ model

RECALL MEMORY 05-Mar-08 08:32				
APPLIANCE: 0045771944				
TEST SITE: METREL				
LOCATION: CONFERENCE ROOM				
USER: USER 1				
		PASS		
FUNCTIONS	PARAMETERS	LIMIT	RESULTS	S
VISUAL				
EARTH BOND	10A~	3.00Ω	1.76Ω	P
INSULATION	250V~	10.00MΩ	44.9MΩ	P
SUB LEAKAGE	40V~	3.50mA	0.48mA	P
LEAKAGE	230V~	3.00mA	0.98mA	P
PgUp PgDown MORE				

UK model

View results menu

Use the ESC key to return to **Recall results** or **Search results menus**.

From the **Recall results menu** stored data can be downloaded to a PC, printed out to a serial printer or deleted from the memory. Refer to chapters **8.4 Downloading and printing results** and **8.3 Deleting results**, respectively.

Note on Aus/NZ model:

- Stored result with 2 appliances give 2 results. The number in brackets equals the number of appliance IDs ((1) indicates results with one appliance ID and (2) indicates results with two appliance IDs). For selected appliance number some appliance data are also viewed in this menu.

8.3 Deleting results

Stored autotest results can also be deleted from the memory.

Enter **Recall results menu** from **Main menu**. Recall the result(s) you want to delete (Refer to chapter **8.2 Recalling results** for detailed information on recalling results). In the **Recall results** menu, press F5 function key. **Delete results** menu will be displayed.

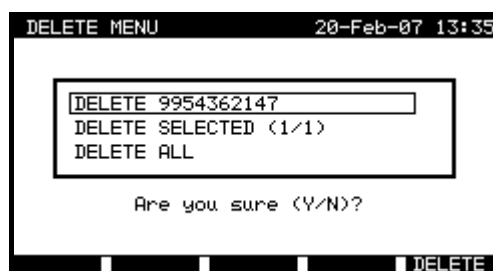
RECALL MEMORY		28-Feb-08 13:33	
APPLIANCE: 01003			
SITE:		PASS	
BUILDING: BUILDING 1			
ROOM: ROOM 1			
TIME/DATE: 07:34 30.01.2008			
USER: USER 1			
01000 01003 01000 01000 01000 01000			
PgUp PgDown SEND SENDall DELETE			

Aus/ NZ model

RECALL MEMORY		05-Mar-08 08:30	
APPLIANCE: 0045771944			
TEST SITE: METREL			
LOCATION: CONFERENCE ROOM		PASS	
TIME/DATE: 11:34 28.02.2008			
USER: USER 1			
10904 16608 0045771944 0045771944 0006000			
PgUp		PgDown	
SEND		SENDall	
DELETE			

UK model

Recall results menu



Delete results menu

In this menu the following functions can be performed.

- › DELETE: deletes the single file last highlighted when the F5 function key was pressed,
- › DELETE SELECTED: deletes all the files found from searching the memory of the instrument,
- › DELETE ALL: clears all stored test data from the instrument.

By using ▲ and ▼ cursor keys select the option required and press the F5 function key. Confirm the delete activity by using Y key. After performing the selected option, instrument returns to **Recall results** menu accepting the new memory state. If you don't want delete the results, press the N key in **Delete results** menu. Instrument returns to **Recall results** menu without any changes.

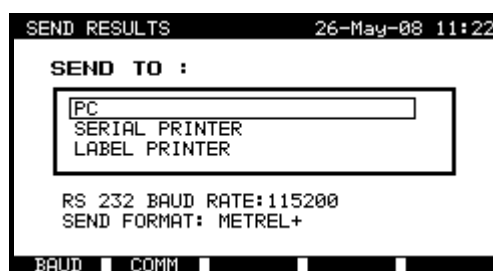
8.4 Downloading and printing results

Autotest results can be sent to the PC for other activities or printed out using a serial printer or special label printers.

The autotest results can be downloaded to PC or sent to printer:

- › after autotest sequence is completed, or
- › after recalling stored results from the instrument memory.

By pressing the F3 function key in the **Save results** or **Recall results menus**, **Send results** menu is available.



Send results menu

From this menu the autotest results can be:

- › sent to PC, or
- › printed out.

By using ▲ and ▼ cursor keys, select the activity you want to perform. The actual settings for selected activity will be displayed under the activity box.

Use the F1 and F2 function keys to set the settings for selected activity, then press ENTER key to start selected activity.

Refer to chapters **8.4.2 Settings for generic serial printer**, **8.4.3 Settings for label printers** and **9.3.6 Instrument settings** for more information.

```
.....
METREL
Testing laboratory
Horjul, Slovenia
.....
```

```
APPLIANCE          11072010
TEST SITE          METREL
LOCATION             OFFICE 1
TIME/DATE          09:31 11-JUL-2008
USER               TOMAZ
RESULT:            PASS
-----
VISUAL              PASS
EARTH BOND It: 10A~ Rlim: 0.10 Ohm
1. R =             0.03 Ohm PASS
INSULATION Ut: 500V Rlim: 1.00 MOhm
1. R =             178.9 MOhm PASS
LEAKAGE Ut: 230V~ Ilim: 0.75 mA
1. I =             0.23 mA PASS
POWER
1. P =             2.01KVA PASS
APPLIANCE NAME: APP 1
RETEST PERIOD : 11/07/2009
REPAIRING CODE: 021268505
COMMENTS: -
=====
```

```
.....
METREL
Testing laboratory
Horjul, Slovenia
.....

APPLIANCE          11072011
SITE              METREL
BUILDING           METREL
LOCATION             OFFICE 1
TIME/DATE          09:54 11-JUL-2008
USER               PETER
RESULT:            PASS
-----
VISUAL              PASS
EARTH BOND It: 10A~ Rlim: 1.00 Ohm
1. R =             0.21 Ohm PASS
INSULATION Ut: 500V Rlim: 1.00 MOhm
1. R =             161.3 MOhm PASS
APPLIANCE NAME: APP 1
RETEST PERIOD : 11/07/2009
REPAIRING CODE: 081276501
COMMENTS: -
=====
```

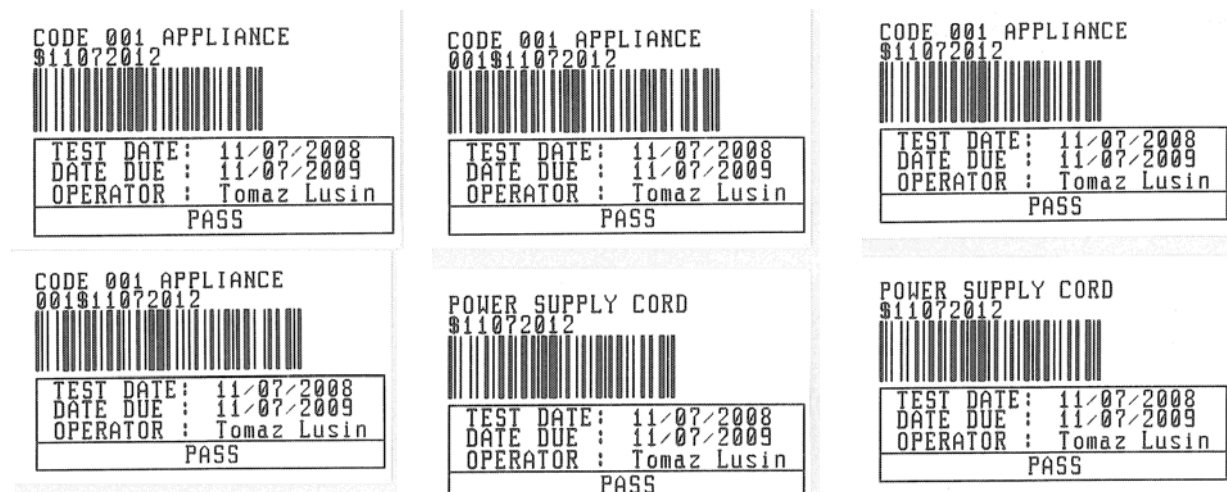
END OF DATA

END OF DATA

UK model

Aus/NZ model

Example of data sent to serial printer



*1 tag, barcode system:
single (top label)*

*2 tags, barcode system:
double*

*2 tags, barcode system:
single*

*1 tag, barcode system:
double (bottom label)*

Examples of appliance labels for UK model

Electrical Safety
TestingNZ WIDE TEST'n'Tag
Professionals

Tel: 0800 638 768

--- CENTRE CABLE HERE ---

AS3760 TEST TAG

CODE 101 APPLIANCE

101711072011



TEST DATE: 11/07/2008 RETEST DATE: 11/07/2009

USER: USER 1

TEST STATUS: PASS

1 tag, barcode system: double

Electrical Safety
TestingNZ WIDE TEST'n'Tag
Professionals

Tel: 0800 638 768

--- CENTRE CABLE HERE ---

AS3760 TEST TAG

CODE 101 APPLIANCE

711072011



TEST DATE: 11/07/2008 RETEST DATE: 11/07/2009

USER: USER 1

TEST STATUS: PASS

1 tag, barcode system: single

Electrical Safety
TestingNZ WIDE TEST'n'Tag
Professionals

Tel: 0800 638 768

--- CENTRE CABLE HERE ---

AS3760 TEST TAG

CODE 001 APPLIANCE

001<11072008



TEST DATE: 11/07/2008 RETEST DATE: 11/07/2009

USER: USER 1

TEST STATUS: PASS

2 tags, barcode system: double

Electrical Safety
TestingNZ WIDE TEST'n'Tag
Professionals

Tel: 0800 638 768

--- CENTRE CABLE HERE ---

AS3760 TEST TAG

POWER SUPPLY CORD

>11072009



TEST DATE: 11/07/2008 RETEST DATE: 11/07/2009

USER: USER 1

TEST STATUS: PASS

Electrical Safety
TestingNZ WIDE TEST'n'Tag
Professionals

Tel: 0800 638 768

--- CENTRE CABLE HERE ---

AS3760 TEST TAG

CODE 001 APPLIANCE

<11072008



TEST DATE: 11/07/2008 RETEST DATE: 11/07/2009

USER: USER 1

TEST STATUS: PASS

2 tags, barcode system: single

Electrical Safety
TestingNZ WIDE TEST'n'Tag
Professionals

Tel: 0800 638 768

--- CENTRE CABLE HERE ---

AS3760 TEST TAG

POWER SUPPLY CORD

>11072009



TEST DATE: 11/07/2008 RETEST DATE: 11/07/2009

USER: USER 1

TEST STATUS: PASS

Examples of appliance labels for Aus/NZ model

Note:

- When working with serial printers, baud rate is set by default to 9600 bps.
- Printing appliance labels using label printers is password protected (Aus/NZ model). For more information please contact your distributor.

8.4.1 Communication ports settings for communication with PC

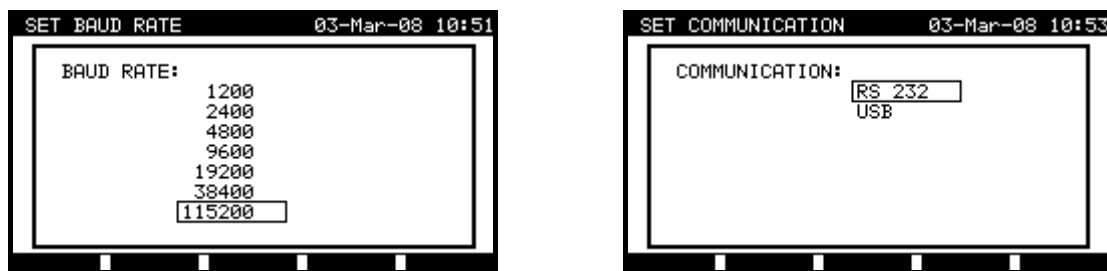
Instrument includes both RS 232 and USB communication ports for communicating with a PC.

The appropriate communication port can be set:

- when **Send to PC** option is selected in **Send results menu**,
- in **Main menu / Setup / Set communication menu** (refer to chapter 9.3.8 **Communication settings** for more information).

Press F1 function key in **Send results** menu to enter the **Baud rate** submenu.

Press F2 function key in **Send results** menu to enter the **Communication port** submenu.



Communication ports settings

By using the $\blacktriangle$ and $\blacktriangledown$ cursor keys, select communication port / baud rate you want to use for communication between instrument and PC. Once the communication port / baud rate have been selected, press ENTER key to confirm. The instrument returns to the **Send results menu** with new settings accepted.

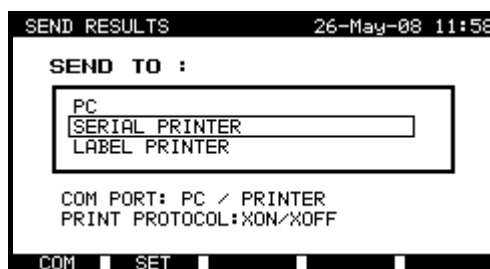
By using the ESC key in **Communication port** or **Baud rate submenu**, the instrument returns to the **Send results menu** without any changes.

Note:

- Only one port can be active at one time.

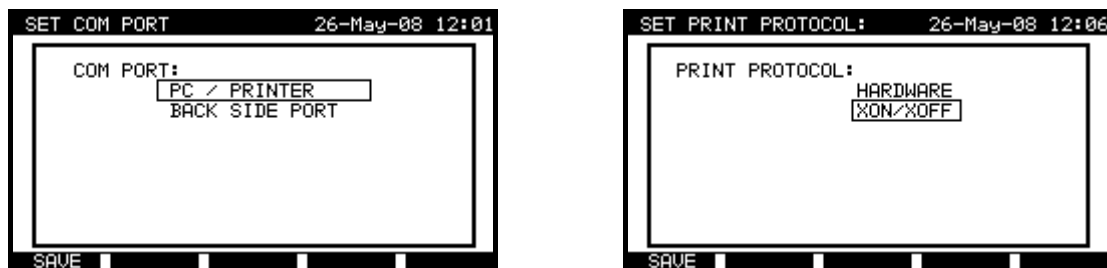
8.4.2 Settings for generic serial printer

Measuring results can be printed out on a serial printer via the RS232 («PC/PRINTER») communication port. When a serial printer is used for printing autotest results, communication port and printer data transfer protocol must first be selected correctly.



Sending results to serial printer

Press F1 function key in **Send results** menu to enter **Communication port** submenu. Press F2 function key in **Send results** menu to enter **Printer protocol** submenu.



Communication port / printer protocol settings

By using the ▲ and ▼ cursor keys select communication port / printer protocol supported by used serial printer.

Once the communication port / printer data transfer protocol is selected, press the F1 function key or ENTER key to confirm. The instrument will return to **Send results menu** with new settings accepted.

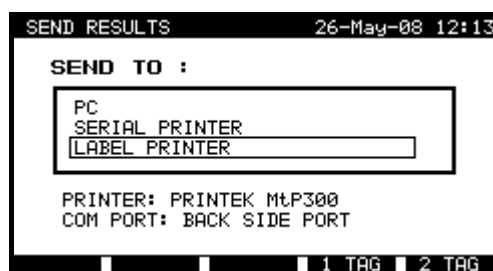
By using the ESC key in the **Communication port** or **Print protocol menu**, the instrument returns to **Send results menu** without any changes.

Notes:

- When working with serial printers, the baud rate is set by default to 9600 bps.
- Software transfer control uses XON (CTRL-Q) and XOFF (CTRL-S) characters.
- Hardware transfer control uses DTR line.
- Back side port supports only (XOn/XOff) software transfer control.

8.4.3 Settings for label printer

The instrument also supports printing appliance labels using special label printers. Please contact METREL or distributor for information which label printers are supported (depends on region, instrument 's FW and HW version). Selected type of printer and appropriate communication port are displayed if 'Send to LABEL PRINTER' is selected.



Printing on special label printer

Press the F1 function key in **Send results menu** to enter **Printer** submenu.



Sending results to serial printer

By using ▲ and ▼ cursor keys select the label printer you want to use and press F1 function key or ENTER key to confirm. The instrument will return to **Send results menu** with new settings accepted.

By using ESC key in **Label printer** menu, the instrument will return to **Send results menu** without any changes.

UK model

Press F4 function key in **Send results** menu to print one label.

Press F5 function key in **Send results** menu to print two the same labels.

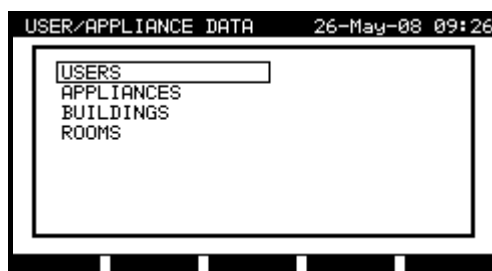
Notes:

- Printing appliance labels using label printer is password protected (Aus / NZ model). For more information please contact your distributor.
- Do not connect Intermec EasyCoder C4 printer to the instrument when printing test results using **Serial printer** option in the **Send results menu**. This may damage label printer!

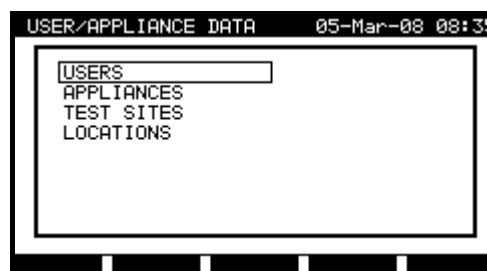
9 Other instrument operations

9.1 User / appliance data menu

In the **User / appliance data** menu, user selection and list information can be edited. In the **Main menu**, select **User / appliance data** ▲ and ▼ cursor keys and pressing ENTER key to confirm. The **User / appliance data** menu is displayed.



Aus/ NZ model



UK model

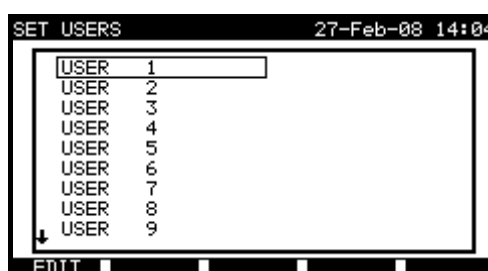
User / appliance data main menu

Existing user names and list data can also be downloaded and edited using PC software and then uploaded back to the instrument. (Refer to the chapter **9.2 Data upload / download** for detailed information)

9.1.1 Users submenu

In this menu user names for up to 15 different users can be entered, edited and selected.

Select **Users** in **User / appliance data** menu by ▲ and ▼ cursor keys and press ENTER key to confirm. The following menu is displayed:



Users submenu

How to rename a user name

To rename a selected user name press the F1 function key. Enter the new user name and press F1 function key again to confirm or press ESC key to return to **User** menu without saving.

By using F2 function key in **Edit users** submenu, user names can be reset to last accepted name.

9.1.2 Appliances submenu

In this menu, default lists of appliance names (up to 100) can be edited.

An alternative is to upload the names from PC software. For more information refer to chapter **9.2 Data upload / download**.

Select **Appliances** in **User / appliance data** menu by ▲ and ▼ cursor keys and press ENTER key to confirm. The following menu is displayed:



Appliances submenu

How to rename an appliance name

To rename a selected appliance name press F1 function key. Enter the new appliance name and press F1 function key again to confirm or press the ESC key to return to the **Appliances** menu without saving.

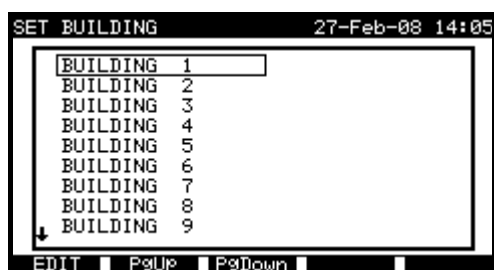
By using F2 function key in **Set appliance** submenu, appliance name can be reset to last accepted name.

9.1.3 Test sites (UK model) / buildings (Aus/NZ model) submenu

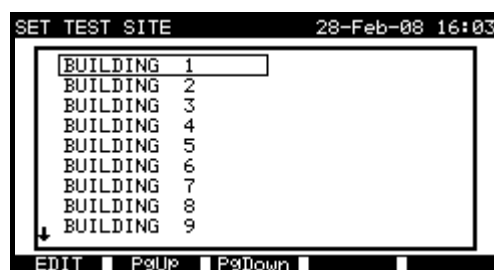
In this menu default lists of test sites / building names (up to 100) can be edited.

An alternative is to upload the names from the PC software. The existing lists can also be downloaded to a PC. For more information refer to chapter **9.2 Data upload / download**.

Select **Test sites / Buildings** in **User / appliance data** menu by ▲ and ▼ cursor keys and press ENTER key to confirm. The following menu will be displayed:



Aus/ NZ model



UK model

Test sites / buildings submenu

How to rename a test site / building name

To rename a selected test site / building name press F1 function key. Enter the new name and press F1 function key again to confirm or press ESC key to return to **Test sites / Buildings** menu without saving.

By using F2 function key in **Edit test site / building** submenu, test site / building name can be reset to the last accepted name.

9.1.4 Locations (UK model) / rooms (Aus/NZ model) submenu

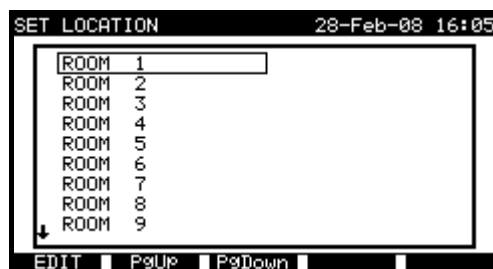
In this menu default lists of location / room names (up to 100) can be edited.

An alternative is to upload the names from the PC. The existing lists can also be downloaded to PC. For more information refer to chapter **9.2 Data upload / download**.

Select **Locations / Rooms** in **User / appliance data** main menu by ▲ and ▼ cursor keys and press ENTER key to confirm. The following menu is displayed:



Aus/ NZ model



UK model

Locations / rooms submenu

How to rename a location / room name

To rename a selected test site / building name press the F1 (EDIT) function key. Enter the new name and press F1 (SAVE) function key again to confirm or press the ESC key to return to **Rooms / Locations** menu without saving.

By using the F2 function key in **Edit room / location** submenu, room / location name can be reset to the last accepted name.

9.2 Data upload / download

Autotests and results from PC software can be uploaded to the instrument from the **Data upload / download menu**. Also the following items can be downloaded and edited or created with PC software and then uploaded onto the instrument:

- users,
- appliances,
- test sites / buildings,
- locations / rooms.



Downloading / uploading test data menu

During the data transfer from the PC to the instrument, the transfer status will be displayed.

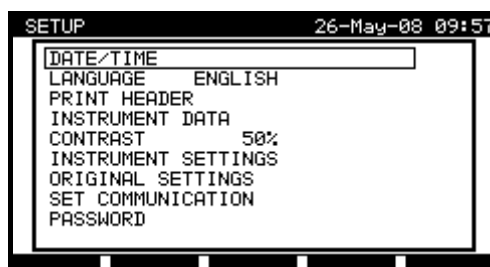
Pressing ESC key instrument returns to **Main menu**.

For detailed information on data uploading / downloading refer to help menus of PC software PATLink PRO.

9.3 Setup menu

In **Setup menu** the general instrument parameters can be configured and saved.

To enter the **Setup menu** select **Setup** in **Main menu** using $\blacktriangle$ and $\blacktriangledown$ keys and press ENTER key to confirm. **Setup menu** will be displayed.



Setup menu

9.3.1 Setting date and time

From the **Main menu**, select **Setup** and the select **Date / time** by using $\blacktriangle$ and $\blacktriangledown$ cursor keys and press ENTER key to confirm. The following menu will be displayed:



Date and time menu

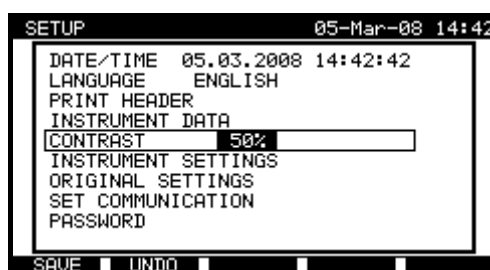
By using ◀ and ▶ keys the date or time field can be selected. To set date and/or time use ▲ and ▼ cursor keys to change the date and time. Press the F1 function key to accept the new settings or press ESC key to return to **Setup menu** without saving.

Notes:

- › Date is attached to the saved autotest results!
- › Date format is DD-MM-YYYY (day–month–year).
- › Date entry is checked for regularity and not accepted in case of irregular date!

9.3.2 Display contrast adjustment

From the **Main menu**, select **Setup** and the select **Contrast** by using ▲ and ▼ cursor keys and press ENTER key to confirm. The following menu will be displayed:



Contrast menu

Use ▲ and ▼ cursor keys to adjust contrast. Press F1 function key to accept the setting or press ESC key to return to **Setup menu** without saving.

9.3.3 Print header

A print header can be set in the instrument which appears when printing autotest results using a serial printer.

From the **Main menu**, select **Setup** and the select **Print header** by using ▲ and ▼ cursor keys and press ENTER key to confirm. The following menu will be displayed:



Print header menu



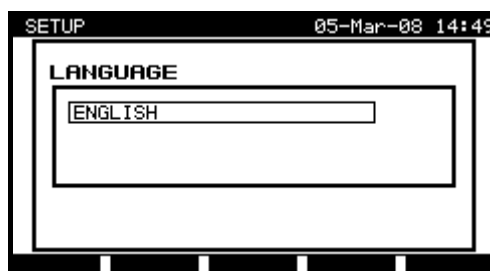
Editing print header

Press the F1 function key to enable print header editing and use the alpha-numeric keyboard to edit print header field.

Press F1 function key again to confirm. Instrument returns to **Setup menu**.
By pressing ESC key instrument returns to **Setup menu** without accept new settings.

9.3.4 Language selection

Select **Language** in **Setup menu** by using ▲ and ▼ cursor keys and press ENTER key. The following menu is displayed:



Language menu

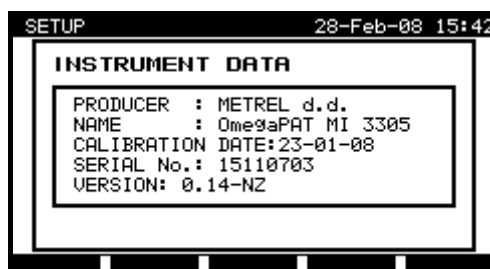
By using ▲ and ▼ cursor keys select language you want to use. Press ENTER key to accept the new language or press ESC key to return to **Setup menu** without any change.

9.3.5 Viewing of instrument data

In this menu the following instrument data are shown:

- producer name,
- instrument name,
- serial number,
- firmware version,
- calibration date.

Select **Instrument data** in **Setup menu** by using ▲ and ▼ cursor keys and press ENTER key. **Instrument data** menu is displayed.



Instrument data menu

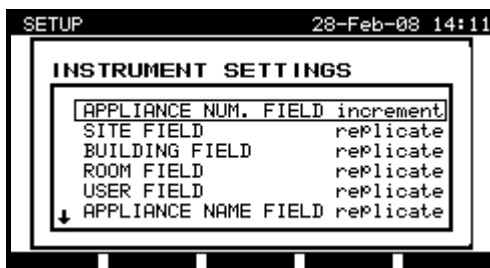
Note:

- Operator cannot change any instrument data!

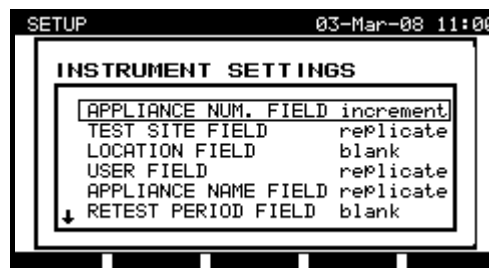
9.3.6 Instrument settings

When an autotest is completed, different data about appliance and other associated data can be added to the autotest results before saving them. In the **Instrument settings** submenu, the settings as to how the data changes between tests can be controlled.

From the **Main menu**, select **Setup** and then select **Instrument settings** by using $\blacktriangle$ and $\blacktriangledown$ cursor keys and press ENTER key to confirm. The **Instrument settings submenu** will be displayed.



Aus/ NZ model



UK model

Instrument settings menu

The following data can be controlled between tests:

UK model

- › appliance number,
- › test site,
- › location,
- › user,
- › appliance name,
- › retest period
- › repairing code,
- › comments,
- › barcode system,
- › save & print option.

Aus/ NZ model

- › appliance number,
- › site,
- › building,
- › room,
- › user,
- › appliance name,
- › retest period,
- › repairing code,
- › comments,
- › barcode system,
- › second tag manipulation,
- › save and print option.

By using $\blacktriangle$ and $\blacktriangledown$ cursor keys select the item whose parameter you want to change and press ENTER key to confirm. Use $\blacktriangle$ and $\blacktriangledown$ cursor keys again to set parameter to your needs. Press F1 function key to confirm. To restore last used setting for selected item press F2 key.

In general, the **blank** and **replicate** options are available. If **blank** is selected for a particular item, then the appropriate field will initially appear blank in the **Save results** menu. If **replicate** option is selected for a particular item, the last entered data will initially appear in an appropriate field when new autotest sequence is finished.

The **increment** option can also be set in the **appliance number** field. In this case, the appliance number will be automatically incremented when new autotest sequence is finished.

Notes on Aus/NZ model:

- › The 2nd appliance number and its name can also be added to the actual autotest results. To activate this functionality **enable** the **2nd tag manipulation**. When **2nd tag manipulation** is **disabled**, then only one appliance number and its name is available in **Save results menu** when new autotest sequence is finished.
- › When **2nd tag manipulation** is **enabled**, two appliance barcode labels are printed out.

Special label printer (*Printek MtP300 / MtP400, Intermec EasyCoder C4, etc*) is also supported by the instrument. When printing barcodes to the special printer, two different options can be set in **Barcode systems** submenu. If **single** option is selected, only appliance name is printed out as a barcode on appliance barcode label. When **double** is selected, both autotest shortcut code and appliance name are printed out as a barcode on appliance barcode label.

After the autotest sequence is completed, the test results can be saved and then immediately sent to PC or printed out using serial (label) printers, if **save & print** option is **enabled**. In this case, **Send results** menu is automatically displayed after saving autotest results.

If **Save & print** option is **disabled**, the instrument returns to **Autotest** menu once the results has been saved.

Notes on Aus/NZ model:

- Special characters (? , > or <) between autotest shortcut code and appliance name (ID number) are used to identify single or double tag. Symbol '?' means that only one tag was used for appliance. Symbols '<' and '>' indicate that two appliance IDs were stored after performing autotest sequence and also two tags were printed out.
- Only appliance ID is printed out on the 2nd appliance label (power supply cord label).

Notes on UK model:

- Special character »\$« between autotest shortcut code and appliance name (ID number) is used to distinguish shortcut code from appliance name.
- Only appliance ID is printed out on the 2nd appliance label (power supply cord label).

9.3.7 Password

In password protected actions, it is necessary to enter the password before deleting or editing the protected data. The instrument requires a password and it will not allow changes unless the correct password has been entered.

From the **Main menu**, select **Setup** and then select **Password** by using ▲ and ▼ cursor keys and press ENTER key to confirm. **Password submenu** will be displayed.



Password menu

Enter a password and then press ENTER key to accept the new password. By pressing the ESC key instrument returns to **Setup menu** without any changes.

Please take a note of this password and keep it in a safe place.

If there is no password protection, the instrument will request that you enter a new password twice, once to confirm.

If the instrument is already password protected, then the instrument will request the old password before entering the new one twice, once to confirm.

To disable the password protection, instead of entering a new password just press the ENTER key when asked for a new password and confirmation and the password will be disabled.

If you forget the password, contact your dealer.

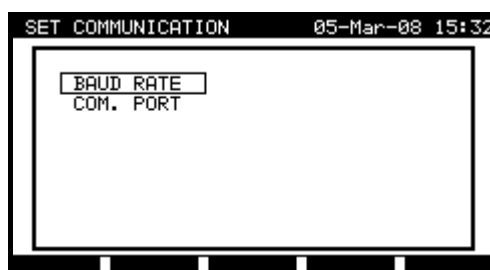
Password protected actions:

- entering **Edit user menu**,
- editing measurement parameters in single / autotest custom test mode,
- deleting stored results,
- entering **Original settings menu**.

9.3.8 Communication settings

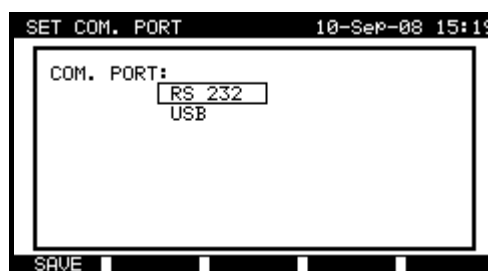
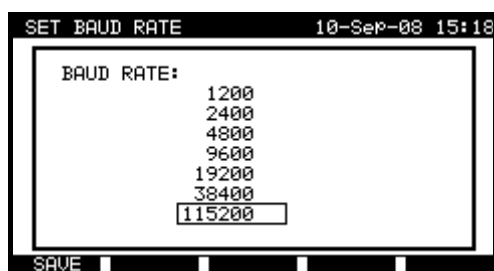
In this menu, the communication port and baud rate can be set for communication with PC.

From the **Main menu**, select **Setup** and then select **Communication** by using ▲ and ▼ cursor keys and pressing ENTER key. The following menu will be displayed:



Communication menu

By using ▲ and ▼ cursor keys select option you want to change and press ENTER key to confirm. One of the following menus is displayed:



Communication settings

By using ▲ and ▼ cursor keys, select the communication port / baud rate you want to use for communication between instrument and PC. Once the communication port / baud rate is selected, press the ENTER key (or F1 function key) to confirm. The instrument returns to **Communication menu** with new settings accepted.

By using ESC key in the **Communication port** or **Baud rate submenu**, the instrument will return to **Communication menu** without any changes.

Note:

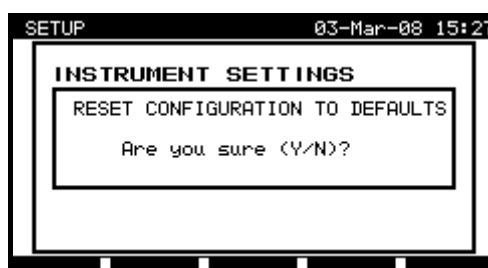
- › Only one port can be active at one time.

9.3.9 Reset instrument settings

In this menu the following parameters can be set to their initial values:

- › all measurement parameters in single test mode,
- › user defined tests are cleared,
- › 8 autotest sequences with all measurements disabled are added,
- › all menus are set to their initial structure,
- › PC baud rate is set to 115000 bps,
- › printer protocol is set to hardware (DTR).

Select **Original settings** in **Setup menu** by using ▲ and ▼ cursor keys and press ENTER key to confirm. The following menu is displayed:



Original settings menu

Select YES to confirm, or NO to quit without changes.

10 Maintenance

10.1 Periodic calibration

It is essential that all measuring instruments are regularly calibrated in order for the technical specification listed in this manual to be guaranteed. We recommend an annual calibration. The calibration should be done by an authorized technical person only.

10.2 Fuses

There are two fuses available from front panel:

F1 = F2 = T 16 A / 250 V (32 × 6,3 mm): intended for instrument protection.

If the instrument does not respond after connection to mains supply, disconnect the mains supply and accessories and then check these fuses. For position of fuses refer to chapter **2.1 Front panel**.

Warning!

- Switch off the instrument and disconnect all test accessories and mains cord before replacing the fuses or opening the instrument. Disconnect all test leads and the instrument mains cord before removing fuse cover!
- Replace blown fuse with the same type.

10.3 Service

For repairs under or out of warranty time please contact your distributor for further information.

Unauthorized person is not allowed to open the OmegaPATPlus / BetaPATPlus instrument. There are no user replaceable components inside the instrument.

10.4 Cleaning

Use a soft, slightly moistened cloth with soap water or alcohol to clean the surface of OmegaPATPlus / BetaPATPlus instrument. Leave the instrument to dry totally before using it.

Notes:

- Do not use liquids based on petrol or hydrocarbons!
- Do not spill cleaning liquid over the instrument!

11 Instrument set and accessories

Standard set of the instrument

- › Instrument MI 3305 – OmegaPATPlus / MI 3304 – BetaPATPlus
- › Additional bag for accessories inside carrying case
- › Test probe (earth bond clip)
- › Flash test probe (MI 3305 only)
- › PRCD test probe
- › Test lead (1.5 m, green)
- › Test lead (1.5 m, black)
- › Test tip (green)
- › Test tip (black)
- › Alligator clip (green)
- › Alligator clip (black)
- › PC software PATLink PRO with RS232 and USB cables
- › User manual
- › Production verification data

Optional accessories

See the attached sheet for a list of optional accessories that are available on request from your distributor.

A Autotest shortcut parameters

APPLIANCE TYPE

- › portable or handheld appliances,
- › heating and cooking appliances,
- › IT (information technology) equipment (EN60950),
- › extension leads,
- › 3-phase (Aus / NZ model only),
- › multibox (Aus / NZ model only),
- › mineral insulated heating elements (Aus / NZ model only),
- › RCD protected appliances (Aus / NZ model only).

Most electrical appliances belong to one of these above-mentioned types. The tests and limits differ slightly depending on the specific regulation.

In general the following tests must be performed during an *in service* test:

Class I equipment:

- › visual check,
- › earth bond resistance,
- › insulation resistance,
- › functional test.

Class II equipment:

- › visual check,
- › insulation resistance,
- › functional test.

Notes:

- › For portable and handheld appliances the leakage (or touch leakage) limits are stricter than for other types.
- › For IT equipment the earth bond resistance measurement is performed with low current (100 mA) in order to avoid any damage to earth connections for EMC (screening) purposes.
- › For cooking and heating appliances the leakage limit is set higher because some leakage typically occurs in the heating elements. Therefore the substitute leakage current measurement is performed instead of insulation resistance measurement.
- › The IT equipment must conform to the EN60950 regulations. Otherwise the equipment may be damaged during the insulation resistance measurement!

APPLIANCE SAFETY CLASS

- › Class I
- › Class II

FUSE: 3 A (750 VA), 6 A (1.5 kVA), 10 A (2.5 kVA), 13 A (3.2 kVA), unknown

SUPPLY CORD: short, middle (or low c.s.a.), long

<i>Cord</i>	<i>Earth bond limit</i>	<i>Appliance fuse</i>	<i>Power</i>	<i>Nominal conductor c.s.a.</i>	<i>Appliance supply cord length</i>
SHORT	0.10 Ω	3 A	750 VA	0.5 mm ² (39 m Ω /m)	2.5 m
		6 A	1.5 kVA	0.75 mm ²	3.5 m
		10 A	2.5 kVA	1 mm ²	5 m
		13 A	3.2 kVA	1.25 mm ²	6 m
MIDDLE	0.30 Ω	3 A	750 VA	0.5 mm ²	7.5 m
		6 A	1.5 kVA	0.75 mm ²	11.5 m
		10 A	2.5 kVA	1 mm ²	15 m
		13 A	3.2 kVA	1.25 mm ²	19 m
LONG	0.50 Ω	3 A	750 VA	0.5 mm ²	12.5 m
		6 A	1.5 kVA	0.75 mm ²	19 m
		10 A	2.5 kVA	1 mm ²	25 m
		13 A	3.2 kVA	1.25 mm ²	32 m

<i>Nominal conductor c.s.a.</i>	<i>Nominal conductor resistance</i>
0.5 mm ²	39 m Ω /m
0.75 mm ²	26 m Ω /m
1 mm ²	19.5 m Ω /m
1.25 mm ²	15.6 m Ω /m

See Code of practice for in-service inspection and testing of electrical equipment, 3rd edition, page 124

- The earth bond limit depends significantly on the supply cord length and its PE wire cross-section area.
- SHORT should be set for appliances with a cord not longer than 5 m.
- MEDIUM can be used when the appliance supply cord is longer than 5 m or the cord wire has a small cross-section area.
- LONG can be used if the appliance has a very long supply cord (for instance vacuum cleaners).
- The power means the maximum power that can be delivered in combination with the set fuse. Some users are more familiar with the nominal power than the fuse rating.

FUNCTIONAL / PROTECTIVE CONDUCTOR TEST: yes, no

LENGTH: $\leq$ 5 m, 7.5 m, 10 m, 12 m, 15 m, 20 m, 30 m, 40 m, 50 m

CONDUCTOR CROSS-SECTION: 0.5 mm², 0.75 mm², 1.0 mm², 1.25 mm², 1.5 mm², unknown

MAX. CURRENT CAPACITY: 3 A (<750 VA), 6A (1.5 kVA), 10 A (2.5 kVA), 13 A (3.2 kVA), 15 A (3.75 kVA)

B Autotest shortcut codes (Aus / NZ model)

Code No.	Visual
001	☒

Portable or handheld																		
Code No.	Class	Visual	Earth bond (1 st test)			Eart bond (2 nd test)			Insulation			Substitute leakage	Leakage		Touch leakage	Polarity test	TRMS current (current clamp adapter)	
			Test current	Pass limit	Test duration	Test current	Pass limit	Test duration	Test voltage	Pass limit	Test duration		Pass limit	Test duration			Pass limit	Time duration
101	1	☑	10 A	1.00 Ω	5 s	☑			500 V	1.00 MΩ	3 s	☑	☑		☑	☑	☑	☑
102	1	☑	25 A	1.00 Ω	5 s	☑			500 V	1.00 MΩ	3 s	☑	☑		☑	☑	☑	☑
103	1	☑	10 A	1.00 Ω	5 s	☑			☑			☑	5.00 mA	5 s	☑	☑	☑	☑
104	1	☑	25 A	1.00 Ω	5 s	☑			☑			☑	5.00 mA	5 s	☑	☑	☑	☑
105	1	☑	10 A	1.00 Ω	5 s	☑			250 V	1.00 MΩ	3 s	☑	☑		☑	☑	☑	☑
106	1	☑	25 A	1.00 Ω	5 s	☑			250 V	1.00 MΩ	3 s	☑	☑		☑	☑	☑	☑
107	1	☑	10 A	0.50 Ω	5 s	☑			500 V	2.00 MΩ	3 s	☑	☑		☑	☑	☑	☑
108	1	☑	25 A	0.50 Ω	5 s	☑			500 V	2.00 MΩ	3 s	☑	☑		☑	☑	☑	☑
109	1	☑	10 A	0.50 Ω	5 s	☑			☑			☑	3.50 mA	5 s	☑	☑	☑	☑
110	1	☑	25 A	0.50 Ω	5 s	☑			☑			☑	3.50 mA	5 s	☑	☑	☑	☑
111	1	☑	10 A	0.50 Ω	5 s	☑			250 V	2.00 MΩ	3 s	☑	☑		☑	☑	☑	☑
112	1	☑	25 A	0.50 Ω	5 s	☑			250 V	2.00 MΩ	3 s	☑	☑		☑	☑	☑	☑
170	1	☑	25 A	1.00 Ω	5 s	☑			☑			☑	5.00 mA	30 s	☑	☑	☑	☑
171	1	☑	25 A	1.00 Ω	3 s	☑			500 V	1.00 MΩ	3 s	☑	☑		☑	☑	5.00 mA	5 s
172	1	☑	25 A	1.00 Ω	3 s	☑			500 V	1.00 MΩ	3 s	☑	☑		☑	☑	1.00 mA	5 s
173	1	☑	25 A	1.00 Ω	3 s	☑			☑			☑	1.00 mA	5 s	☑	☑	☑	☑
174	1	☑	100 mA	1.00 Ω	3 s	25 A	1.00 Ω	3 s	☑			☑	5.00 mA	5 s	☑	☑	☑	☑
175	1	☑	100 mA	1.00 Ω	3 s	25 A	1.00 Ω	3 s	500 V	1.00 MΩ	3 s	☑	☑	☑	☑	☑	☑	☑
201	2	☑	☑			☑			500 V	1.00 MΩ	5 s	☑	☑		☑	☑	☑	☑
202	2	☑	☑			☑			500 V	2.00 MΩ	5 s	☑	☑		☑	☑	☑	☑
203	2	☑	☑			☑			250 V	1.00 MΩ	5 s	☑	☑		☑	☑	☑	☑
204	2	☑	☑			☑			500 V	2.00 MΩ	5 s	☑	☑		☑	☑	☑	☑
205	2	☑	☑			☑			500 V	1.00 MΩ	5 s	☑	☑		☑	☑	☑	☑
206	2	☑	☑			☑			500 V	2.00 MΩ	5 s	☑	☑		☑	☑	☑	☑
207	2	☑	☑			☑			500 V	0.01 MΩ	5 s	☑	☑		☑	☑	☑	☑
208	2	☑	☑			☑			☑			☑	1.00 mA	5 s	☑	☑	☑	☑
209	2	☑	☑			☑			☑			☑	0.50 mA	5 s	☑	☑	☑	☑
218	2	☑	☑			☑			☑			☑	1.00 mA	30 s	☑	☑	☑	☑
219	2	☑	☑			☑			250 V	10.00 MΩ	3 s	☑	☑		☑	☑	☑	☑
220	2	☑	☑			☑			500 V	10.00 MΩ	3 s	☑	☑		☑	☑	☑	☑

Heating and Cooking																
Code No.	Class	Visual	Earth bond (1 st test)			Eart bond (2 nd test)		Insulation			Substitute leakage	Leakage	Touch leakage	Polarity test	TRMS current (current clamp adapter)	
			Test current	Pass limit	Test duration			Test voltage	Pass limit	Test duration						
113	1	☑	10 A	1.00 Ω	5 s	☑		500 V	1.00 MΩ	3 s	☑	☑	☑	☑		☑
114	1	☑	25 A	1.00 Ω	5 s	☑		500 V	1.00 MΩ	3 s	☑	☑	☑	☑		☑
115	1	☑	10 A	0.50 Ω	5 s	☑		500 V	2.00 MΩ	3 s	☑	☑	☑	☑		☑
116	1	☑	25 A	0.50 Ω	5 s	☑		500 V	2.00 MΩ	3 s	☑	☑	☑	☑		☑
117	1	☑	10 A	1.00 Ω	5 s	☑		500 V	0.01 MΩ	3 s	☑	☑	☑	☑		☑
118	1	☑	25 A	1.00 Ω	5 s	☑		500 V	0.01 MΩ	3 s	☑	☑	☑	☑		☑
119	1	☑	10 A	0.50 Ω	5 s	☑		500 V	0.01 MΩ	3 s	☑	☑	☑	☑		☑
120	1	☑	25 A	0.50 Ω	5 s	☑		500 V	0.01 MΩ	3 s	☑	☑	☑	☑		☑

IT equipment (EN 60950)																
Code No.	Class	Visual	Earth bond (1 st test)			Eart bond (2 nd test)		Insulation			Substitute leakage	Leakage		Touch leakage	Polarity test	TRMS current (current clamp adapter)
			Test current	Pass limit	Test duration			Test voltage	Pass limit	Test duration		Pass limit	Test duration			
121	1	☑	100 mA	1.00 Ω	5 s	☑		500 V	1.00 MΩ	3 s	☑	☑		☑	☑	☑
122	1	☑	100 mA	1.00 Ω	5 s	☑		250 V	1.00 MΩ	3 s	☑	☑		☑	☑	☑
123	1	☑	100 mA	0.50 Ω	5 s	☑		500 V	2.00 MΩ	3 s	☑	☑		☑	☑	☑
124	1	☑	100 mA	0.50 Ω	5 s	☑		250 V	2.00 MΩ	3 s	☑	☑		☑	☑	☑
125	1	☑	100 mA	1.00Ω	5 s	☑		☑			☑	5.00 mA	3 s	☑	☑	☑
126	1	☑	100 mA	0.50 Ω	5 s	☑		☑			☑	3.50 mA	3 s	☑	☑	☑
210	2	☑				☑		500 V	1.00 MΩ	3 s	☑	☑		☑	☑	☑
211	2	☑		☑		☑		250 V	1.00 MΩ	3 s	☑	☑		☑	☑	☑
212	2	☑	☑			☑		500 V	2.00 MΩ	3 s	☑	☑		☑	☑	☑
213	2	☑	☑			☑		250 V	2.00 MΩ	3 s	☑	☑		☑	☑	☑
214	2	☑		☑		☑		☑			☑	1.00 mA	5 s	☑	☑	☑
215	2	☑		☑		☑		☑			☑	0.50 mA	5 s	☑	☑	☑

IEC leads / Extension leads																	
Code No.	Class	Visual	Earth bond (1 st test)			Earth bond (2 nd test)			Insulation			Substitute leakage	Leakage		Touch leakage	Polarity test	TRMS current (current clamp adapter)
			Test current	Pass limit	Test duration	Test current	Pass limit	Test duration	Test voltage	Pass limit	Test duration		Pass limit	Test duration			
127	1	☒	100 mA	1.00 Ω	5 s	25 A	1.00 Ω	2 s	500 V	1.00 M Ω	3 s	☒	☒		☒	☒	☒
128	1	☒	100 mA	1.00 Ω	5 s	☒			500 V	1.00 M Ω	3 s	☒	☒		☒	☒	☒
129	1	☒	10 A	1.00 Ω	5 s	☒			500 V	1.00 M Ω	3 s	☒	☒		☒	☒	☒
130	1	☒	10 A	1.00 Ω	5 s	☒			500 V	1.00 M Ω	3 s	☒	☒		☒	☒	☒
131	1	☒	25 A	1.00 Ω	5 s	☒			500 V	1.00 M Ω	3 s	☒	☒		☒	☒	☒
132	1	☒	25 A	1.00 Ω	5 s	☒			500 V	1.00 M Ω	3 s	☒	☒		☒	☒	☒
133	1	☒	100 mA	0.50 Ω	5 s	☒			500 V	1.00 M Ω	3 s	☒	☒		☒	☒	☒
134	1	☒	100 mA	0.50 Ω	5 s	25 A	0.50 Ω	2 s	500 V	1.00 M Ω	3 s	☒	☒		☒	☒	☒
135	1	☒	100 mA	0.50 Ω	5 s	☒			500 V	1.00 M Ω	3 s	☒	☒		☒	☒	☒
136	1	☒	100 mA	1.00 Ω	5 s	☒			500 V	1.00 M Ω	3 s	☒	☒		☒	☒	☒
137	1	☒	10 A	0.50 Ω	5 s	☒			500 V	2.00 M Ω	3 s	☒	☒		☒	☒	☒
138	1	☒	25 A	0.50 Ω	5 s	☒			500 V	2.00 M Ω	3 s	☒	☒		☒	☒	☒
139	1	☒	100 mA	1.00 Ω	5 s	☒			☒			☒	1.00 mA	5 s	☒	☒	☒
140	1	☒	100 mA	1.00 Ω	5 s	☒			☒			☒	1.00 mA	5 s	☒	☒	☒
141	1	☒	10 A	1.00 Ω	5 s	☒			☒			☒	1.00 mA	5 s	☒	☒	☒
142	1	☒	10 A	1.00 Ω	5 s	☒			☒			☒	1.00 mA	5 s	☒	☒	☒
143	1	☒	25 A	1.00 Ω	5 s	☒			☒			☒	1.00 mA	5 s	☒	☒	☒
144	1	☒	25 A	1.00 Ω	5 s	☒			☒			☒	1.00 mA	5 s	☒	☒	☒
217	2	☒	☒			☒			500 V	1.00 M Ω	3 s	☒	☒		☒	☒	☒

IEC leads / Extension leads			Earth bond (1 st test) Continuous mode			Earth bond (2 nd test)	Insulation	Substitute leakage	Leakage		Touch leakage	Polarity test	TRMS current (current clamp adapter)
Code No.	Class	Visual	Test current	Pass limit	Test duration				Pass limit	Test duration			
145	1	☒	100 mA	1.00 Ω	5 s	☒	☒	☒	1.00 mA	5 s	☒	☒	☒
146	1	☒	100 mA	1.00 Ω	5 s	☒	☒	☒	1.00 mA	5 s	☒	☒	☒
147	1	☒	25 A	1.00 Ω	5 s	☒	☒	☒	1.00 mA	5 s	☒	☒	☒
148	1	☒	25 A	1.00 Ω	5 s	☒	☒	☒	1.00 mA	5 s	☒	☒	☒

3-phase			Earth bond (1 st test) Continuous mode			Earth bond (2 nd test)	Insulation	Substitute leakage	Leakage	Touch leakage	Polarity test	TRMS current (current clamp adapter)	
Code No.	Class	Visual	Test current	Pass limit	Test duration							Pass limit	Test duration
149	1	☒	10 A	1.00 Ω	5 s	☒	☒	☒	☒	☒	☒	1.00 mA	5 s
150	1	☒	10 A	1.00 Ω	5 s	☒	☒	☒	☒	☒	☒	5.00 mA	5 s
151	1	☒	25 A	1.00 Ω	5 s	☒	☒	☒	☒	☒	☒	1.00 mA	5 s
152	1	☒	25 A	1.00 Ω	5 s	☒	☒	☒	☒	☒	☒	5.00 mA	5 s
153	1	☒	10 A	1.00 Ω	5 s	☒	☒	☒	☒	☒	☒	1.00 mA	30 s
154	1	☒	10 A	1.00 Ω	5 s	☒	☒	☒	☒	☒	☒	5.00 mA	30 s
155	1	☒	25 A	1.00 Ω	5 s	☒	☒	☒	☒	☒	☒	1.00 mA	30 s
156	1	☒	25 A	1.00 Ω	5 s	☒	☒	☒	☒	☒	☒	5.00 mA	30 s
157	1	☒	25 A	1.00 Ω	5 s	☒	☒	☒	☒	☒	☒	5.00 mA	120 s
158	1	☒	25 A	1.00 Ω	5 s	☒	☒	☒	☒	☒	☒	5.00 mA	180 s
216	2	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	1.00 mA	5 s

Mineral insulated elements			Earth bond (1 st test) Continuous mode			Earth bond (2 nd test)	Insulation			Substitute leakage	Leakage		Touch leakage	Polarity test	TRMS current (current clamp adapter)
Code No.	Class	Visual	Test current	Pass limit	Test duration		Test voltage	Pass limit	Test duration		Pass limit	Test duration			
159	1	☒	10 A	1.00 Ω	5 s	☒	500 V	0.10 M Ω	3 s	☒	☒	☒	☒	☒	☒
160	1	☒	10 A	1.00 Ω	5 s	☒	500 V	0.01 M Ω	3 s	☒	☒	☒	☒	☒	☒
161	1	☒	25 A	1.00 Ω	5 s	☒	500 V	0.01 M Ω	3 s	☒	☒	☒	☒	☒	☒
162	1	☒	10 A	1.00 Ω	5 s	☒	☒	☒	☒	☒	2.50 mA	5 s	☒	☒	☒

Multibox			Earth bond (1 st test) Continuous mode			Earth bond (2 nd test) Continuous mode			Insulation			Substitute leakage	Leakage		Touch leakage	Polarity test	TRMS current (current clamp adapter)
Code No.	Class	Visual	Test current	Pass limit	Test duration	Test current	Pass limit	Test duration	Test voltage	Pass limit	Test duration		Pass limit	Test duration			
163	1	☒	100 mA	0.50 Ω	3 s	25 A	0.50 Ω	2 s	500 V	1.00 M Ω	3 s	☒	☒	☒	☒	☒	☒
164	1	☒	100 mA	1.00 Ω	3 s	☒	☒	☒	500 V	1.00 M Ω	3 s	☒	☒	☒	☒	☒	☒
165	1	☒	100 mA	0.50 Ω	3 s	25 A	0.50 Ω	2 s	250 V	1.00 M Ω	3 s	☒	☒	☒	☒	☒	☒
166	1	☒	100 mA	1.00 Ω	3 s	☒	☒	☒	250 V	1.00 M Ω	3 s	☒	☒	☒	☒	☒	☒
167	1	☒	100 mA	0.50 Ω	3 s	☒	☒	☒	☒	☒	☒	☒	1.00 mA	5 s	☒	☒	☒
168	1	☒	100 mA	1.00 Ω	3 s	25 A	1.00 Ω	2 s	☒	☒	☒	☒	1.00 mA	5 s	☒	☒	☒
169	1	☒	100 mA	1.00 Ω	3 s	☒	☒	☒	☒	☒	☒	☒	5.00 mA	5 s	☒	☒	☒

RCD protected appliances																	
Code No.	Class	Visual	Earth bond (1 st test) Continuous mode			Earth bond (2 nd test) Continuous mode			Insulation	Substitute leakage	Leakage		Touch leakage	Polarity test	TRMS current (current clamp adapter)	Portable RCD test	
			Test current	Pass limit	Test duration	Test current	Pass limit	Test duration			Pass limit	Test duration				IΔN	Test:
180	1	☑	100 mA	1.00 Ω	3 s	25 A	1.00 Ω	2 s	☒	☒	2.50 mA	5 s	☒	☑	☒	10 mA	Auto
181	1	☑	100 mA	1.00 Ω	3 s	25 A	1.00 Ω	2 s	☒	☒	2.50 mA	5 s	☒	☒	☒	10 mA	Auto
182	1	☑	100 mA	1.00 Ω	3 s	25 A	1.00 Ω	2 s	☒	☒	2.50 mA	5 s	☒	☑	☒	15 mA	Auto
183	1	☑	100 mA	1.00 Ω	3 s	25 A	1.00 Ω	2 s	☒	☒	2.50 mA	5 s	☒	☒	☒	15 mA	Auto
184	1	☑	100 mA	1.00 Ω	3 s	25 A	1.00 Ω	2 s	☒	☒	2.50 mA	5 s	☒	☑	☒	30 mA	Auto
185	1	☑	100 mA	1.00 Ω	3 s	25 A	1.00 Ω	2 s	☒	☒	2.50 mA	5 s	☒	☒	☒	30 mA	Auto

Meaning of symbols used in autotest shortcut codes tables: ☑ test/measurement enabled, ☒ test/measurement disabled

C Autotest shortcut codes (UK model)

Type	Class	Fuse	Cord	Earth Bond Limit	Out	Insulation Limit	Out	S. Leakage Limit	Leakage Limit	T. Leakage Limit	Code
Portable or Handheld											
	I	3 A	short	0.10 Ω	10 A	1.00 M Ω	500 V	-	0.75 mA	-	001
	I	6 A	short	0.10 Ω	10 A	1.00 M Ω	500 V	-	0.75 mA	-	002
	I	10 A	short	0.10 Ω	25 A	1.00 M Ω	500 V	-	0.75 mA	-	003
	I	13 A	short	0.10 Ω	25 A	1.00 M Ω	500 V	-	0.75 mA	-	004
	I	3 A	short	0.10 Ω	10 A	1.00 M Ω	500 V	-	-	-	005
	I	6 A	short	0.10 Ω	10 A	1.00 M Ω	500 V	-	-	-	006
	I	10 A	short	0.10 Ω	25 A	1.00 M Ω	500 V	-	-	-	007
	I	13 A	short	0.10 Ω	25 A	1.00 M Ω	500 V	-	-	-	008
	I	3 A	midd	0.30 Ω	10 A	1.00 M Ω	500 V	-	0.75 mA	-	009
	I	6 A	midd	0.30 Ω	10 A	1.00 M Ω	500 V	-	0.75 mA	-	010
	I	10 A	midd	0.30 Ω	25 A	1.00 M Ω	500 V	-	0.75 mA	-	011
	I	13 A	midd	0.30 Ω	25 A	1.00 M Ω	500 V	-	0.75 mA	-	012
	I	3 A	midd	0.30 Ω	10 A	1.00 M Ω	500 V	-	-	-	013
	I	6 A	midd	0.30 Ω	10 A	1.00 M Ω	500 V	-	-	-	014
	I	10 A	midd	0.30 Ω	25 A	1.00 M Ω	500 V	-	-	-	015
	I	13 A	midd	0.30 Ω	25 A	1.00 M Ω	500 V	-	-	-	016
	I	3 A	long	0.50 Ω	10 A	1.00 M Ω	500 V	-	0.75 mA	-	017
	I	6 A	long	0.50 Ω	10 A	1.00 M Ω	500 V	-	0.75 mA	-	018
	I	10 A	long	0.50 Ω	25 A	1.00 M Ω	500 V	-	0.75 mA	-	019
	I	13 A	long	0.50 Ω	25 A	1.00 M Ω	500 V	-	0.75 mA	-	020
	I	3 A	long	0.50 Ω	10 A	1.00 M Ω	500 V	-	-	-	021
	I	6 A	long	0.50 Ω	10 A	1.00 M Ω	500 V	-	-	-	022
	I	10 A	long	0.50 Ω	25 A	1.00 M Ω	500 V	-	-	-	023
	I	13 A	long	0.50 Ω	25 A	1.00 M Ω	500 V	-	-	-	024
	II	-	-	-	-	2.00 M Ω	500 V	-	0.25 mA	-	025
	II	-	-	-	-	2.00 M Ω	500 V	-	-	-	026

Type	Class	Fuse	Cord	Earth Bond Limit	Out	Insulation Limit	Out	S. Leakage Limit	Leakage Limit	T. Leakage Limit	Code
Heating and Cooking											
	I	3 A	short	0.10 Ω	10 A	-	-	-	0.75 mA	-	027
	I	6 A	short	0.10 Ω	10 A	-	-	-	1.00 mA	-	028
	I	10 A	short	0.10 Ω	25 A	-	-	-	1.50 mA	-	029
	I	13 A	short	0.10 Ω	25 A	-	-	-	2.25 mA	-	030
	I	3	short	0.10 Ω	10 A	-	-	0.75 mA	-	-	031
	I	6 A	short	0.10 Ω	10 A	-	-	1.00 mA	-	-	032
	I	10 A	short	0.10 Ω	25 A	-	-	1.50 mA	-	-	033
	I	13 A	short	0.10 Ω	25 A	-	-	2.25 mA	-	-	034
	II	-	-	-	-	2.00 M Ω	500 V	-	0.25 mA	-	035
	II	-	-	-	-	2.00 M Ω	500 V	-	-	-	036

Type	Class	Fuse	Cord	Earth Limit	Bond Out	Insulation Limit	Out	S. Leakage Limit	Leakage Limit	T. Leakage Limit	Code
ITEquipment EN 60950											
	I	-	short	0.10 Ω	100 mA	1.00 M Ω	500 V	3.5 mA	-	-	037
	I	-	midd	0.30 Ω	100 mA	1.00 M Ω	500 V	3.5 mA	-	-	038
	I	-	long	0.50 Ω	100 mA	1.00 M Ω	500 V	3.5 mA	-	-	039
ITEquipment EN 60950 – 250V											
	I	-	long	0.50 Ω	100 mA	1.00 M Ω	250 V	3.5 mA	-	-	040

Type	Class	Fuse	Cord	Earth Limit	Bond Out	Insulation Limit	Out	S. Leakage Limit	Leakage Limit	T. Leakage Limit	Code
OTHER											
	I	3 A	short	0.10 Ω	10 A	1.00 M Ω	500 V	-	3.50 mA	-	041
	I	6 A	short	0.10 Ω	10 A	1.00 M Ω	500 V	-	3.50 mA	-	042
	I	10 A	short	0.10 Ω	25 A	1.00 M Ω	500 V	-	3.50 mA	-	043
	I	13 A	short	0.10 Ω	25 A	1.00 M Ω	500 V	-	3.50 mA	-	044
	I	3 A	short	0.10 Ω	10 A	1.00 M Ω	500 V	-	-	-	045
	I	6 A	short	0.10 Ω	10 A	1.00 M Ω	500 V	-	-	-	046
	I	10 A	short	0.10 Ω	25 A	1.00 M Ω	500 V	-	-	-	047
	I	13 A	short	0.10 Ω	25 A	1.00 M Ω	500 V	-	-	-	048
	I	3 A	midd	0.30 Ω	10 A	1.00 M Ω	500 V	-	3.50 mA	-	049
	I	6 A	midd	0.30 Ω	10 A	1.00 M Ω	500 V	-	3.50 mA	-	050
	I	10 A	midd	0.30 Ω	25 A	1.00 M Ω	500 V	-	3.50 mA	-	051
	I	13 A	midd	0.30 Ω	25 A	1.00 M Ω	500 V	-	3.50 mA	-	052
	I	3 A	midd	0.30 Ω	10 A	1.00 M Ω	500 V	-	-	-	053
	I	6 A	midd	0.30 Ω	10 A	1.00 M Ω	500 V	-	-	-	054
	I	10 A	midd	0.30 Ω	25 A	1.00 M Ω	500 V	-	-	-	055
	I	13 A	midd	0.30 Ω	25 A	1.00 M Ω	500 V	-	-	-	056
	I	3 A	long	0.50 Ω	10 A	1.00 M Ω	500 V	-	3.50 mA	-	057
	I	6 A	long	0.50 Ω	10 A	1.00 M Ω	500 V	-	3.50 mA	-	058
	I	10 A	long	0.50 Ω	25 A	1.00 M Ω	500 V	-	3.50 mA	-	059
	I	13 A	long	0.50 Ω	25 A	1.00 M Ω	500 V	-	3.50 mA	-	060
	I	3 A	long	0.50 Ω	10 A	1.00 M Ω	500 V	-	-	-	061
	I	6 A	long	0.50 Ω	10 A	1.00 M Ω	500 V	-	-	-	062
	I	10 A	long	0.50 Ω	25 A	1.00 M Ω	500 V	-	-	-	063
	I	13 A	long	0.50 Ω	25 A	1.00 M Ω	500 V	-	-	-	064
	II	-	-	-	-	2.00 M Ω	500 V	-	0.25 mA	-	065
	II	-	-	-	-	2.00 M Ω	500 V	-	-	-	066

	Length	Earth Limit	Bond Out	Insulation Limit	Out	Polarity	Code
IEC leads							
0.5mm² / 3A							
	<=5 m	0.30 Ω	10 A	1.00 M Ω	500 V	✓	067
	7.5 m	0.40 Ω	10 A	1.00 M Ω	500 V	✓	068
	10 m	0.50 Ω	10 A	1.00 M Ω	500 V	✓	069
	12 m	0.60 Ω	10 A	1.00 M Ω	500 V	✓	070

	15 m	0.70 Ω	10 A	1.00 MΩ	500 V	✓	071
	20 m	0.80 Ω	10 A	1.00 MΩ	500 V	✓	072
	30 m	1.00 Ω	10 A	1.00 MΩ	500 V	✓	073
	40 m	2.00 Ω	10 A	1.00 MΩ	500 V	✓	074
	50 m	2.00 Ω	10 A	1.00 MΩ	500 V	✓	075
0.75mm² / 6 A							
	<=5 m	0.20 Ω	10 A	1.00 MΩ	500 V	✓	076
	7.5 m	0.30 Ω	10 A	1.00 MΩ	500 V	✓	077
	10 m	0.40 Ω	10 A	1.00 MΩ	500 V	✓	078
	12 m	0.40 Ω	10 A	1.00 MΩ	500 V	✓	079
	15 m	0.50 Ω	10 A	1.00 MΩ	500 V	✓	080
	20 m	0.60 Ω	10 A	1.00 MΩ	500 V	✓	081
	30 m	0.90 Ω	10 A	1.00 MΩ	500 V	✓	082
	40 m	1.00 Ω	10 A	1.00 MΩ	500 V	✓	083
	50 m	1.00 Ω	10 A	1.00 MΩ	500 V	✓	084
1 mm² / 10 A							
	<=5 m	0.20 Ω	25 A	1.00 MΩ	500 V	✓	085
	7.5 m	0.20 Ω	25 A	1.00 MΩ	500 V	✓	086
	10 m	0.30 Ω	25 A	1.00 MΩ	500 V	✓	087
	12 m	0.30 Ω	25 A	1.00 MΩ	500 V	✓	088
	15 m	0.40 Ω	25 A	1.00 MΩ	500 V	✓	089
	20 m	0.50 Ω	25 A	1.00 MΩ	500 V	✓	090
	30 m	0.70 Ω	25 A	1.00 MΩ	500 V	✓	091
	40 m	0.90 Ω	25 A	1.00 MΩ	500 V	✓	092
	50 m	4.00 Ω	25 A	1.00 MΩ	500 V	✓	093
1.25mm² / 13A							
	<=5 m	0.20 Ω	25 A	1.00 MΩ	500 V	✓	094
	7.5 m	0.20 Ω	25 A	1.00 MΩ	500 V	✓	095
	10 m	0.30 Ω	25 A	1.00 MΩ	500 V	✓	096
	12 m	0.30 Ω	25 A	1.00 MΩ	500 V	✓	097

	Length	Earth Bond Limit Out		Insulation Limit Out		Polarity	Code
1.5mm ² / 15 A							
	<=5 m	0.20 Ω	25 A	1.00 MΩ	500 V	✓	103
	7.5 m	0.20 Ω	25 A	1.00 MΩ	500 V	✓	104
	10 m	0.20 Ω	25 A	1.00 MΩ	500 V	✓	105
	12 m	0.30 Ω	25 A	1.00 MΩ	500 V	✓	106
	15 m	0.30 Ω	25 A	1.00 MΩ	500 V	✓	107
UNKNOWN							
	<=5 m	0.20 Ω	25 A	1.00 MΩ	500 V	✓	112
	7.5 m	0.20 Ω	25 A	1.00 MΩ	500 V	✓	113
	10 m	0.20 Ω	25 A	1.00 MΩ	500 V	✓	114
	12 m	0.30 Ω	25 A	1.00 MΩ	500 V	✓	115
	15 m	0.30 Ω	25 A	1.00 MΩ	500 V	✓	116
	20 m	0.40 Ω	25 A	1.00 MΩ	500 V	✓	117
	30 m	0.50 Ω	25 A	1.00 MΩ	500 V	✓	118
	40 m	0.60 Ω	25 A	1.00 MΩ	500 V	✓	119
	50 m	0.80 Ω	25 A	1.00 MΩ	500 V	✓	120

Meaning of symbols used in autotest shortcut codes tables:

- ☑ test/measurement enabled,
- ☒ test/measurement disabled

